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Event and Comment

Co-ordination of National Resources.

IN Great Britain there is an increasing force behind the direction and co-ordination of the national economic effort, and what is being done, or being planned to be done, has a direct interest for Australian primary producers.

If we are going to harmonize our war effort and, after the war, our reconstructional effort, co-ordination among all our services and of all our plans must be regarded as a first and vital essential. Admittedly, the job is not as simple as it seems, but without a clearly defined policy and accurate knowledge waste and overlapping will be very difficult to avoid. Already the British Ministry of Economic Warfare is studying ways and means of managing surpluses of food and raw materials now piling up in different countries. The problems which will certainly face us when the war is over demands our close attention now. It is good, especially in the light of the marketing difficulties with which Australian primary producers are now confronted, to observe the growing feeling in Britain that within the boundaries of the British Commonwealth it should, at least, be possible to consider our problems in relation to the financial and economic needs and resources of the Empire at war, and to minimise any dislocation or disruption of the individual economy of Motherland or Dominion under the stress of war conditions.

An inter-departmental committee is now at work in Britain on plans for mitigating the effects of the war on many of our regular markets. In addition, the problems of future production also are being tackled energetically and, doubtless, effectively. There is ahead, however, the much bigger job of building a scheme of large-scale co-operative planning for the immediate post-war period. "If we can put courage and imagination into our programme of post-war reconstruction, democracy can demonstrate its own strength, its own vitality and superiority to the dictatorships."

What are needed, above all things, to-day are vision, courage, and creative statesmanship. After all, man throughout his history has never been able to go very far without vision, courage, and creative statesmanship.

From Ridge to River—Points in Soil Security.

SOIL erosion is as old as the hills. It has been going on ever since pre-historic man, like a gin with a yam stick, gouged the first furrow and rain turned it into mud or wind blew it away as dust. Wherever soil is laid bare to the weather, erosion starts. This weathering of soil, however, should not be confused with what is called geologic erosion. Geologic erosion goes on where there has been no disturbance of natural cover or environment. With geologic erosion, vegetation holds back the movement of surface soil to a rate that, generally, is no more rapid than the rate at which new soil is formed. "It is so slow that one factor balances the other—that is to say, that soil erosion is balanced by a soil-building process, and changes are so nearly imperceptible that generations of men may never see any difference." When vegetation is ripped off the ground and the soil pulverized with plough and harrow, this natural balance is upset. Continuous cultivation may further disturb the natural balance by taking out of the soil materials which help to hold moisture in the soil. When that happens, soil is removed from the surface much faster than nature builds new soil below, hence what is called accelerated erosion. Examples of soil washing may be seen in every paddock, especially on sloping land in places where the normal rainfall is heavy.

Wind erosion may range all the way from a slight disturbance of the surface soil over a small area to the huge dust storms, which in Western Queensland are called "Bedourie showers," and which blow right across the country and out to sea. This swirling dust, according to soil science men, is composed of the richest and finest particles of soil. "The action of the wind on soil is something like the action of a sieve—the lighter particles go up in the air and the coarser particles pile up as soil drifts or sand drifts."

"Up-and-down-farming" is one of the quickest ways of losing soil. And so with our waking up to what soil erosion means, both to individual properties and Queensland at large, we are now devising or adopting or adapting all sorts of means of saving our soil, and, perhaps, saving our soul as well, for to wilfully fail in our duty as trustees of a natural and national heritage to those who come after us is surely a sin against the whole community.

Among these means of saving soil are contour furrowing, strip farming, rotational and cover cropping, the growing of wind breaks, regrassing, grassing of watercourses, and proper pasture management. All these methods of soil security—the prevention of the washing of real wealth from ridge to river and thence to the sea, and the fertility

which goes, or blows, with the wind will be well illustrated with landscape models made to scale at the Brisbane Show next month. Every farmer who is coming down for the Show should make a point of seeing these model landscapes; and, at the same time, it would be well worth while having a look at the models of all sorts of silos, from the cheaply constructed trench to the more elaborate overhead systems. From these exhibits it will be possible to pick up many wrinkles and gadgets that can be applied at no great cost on the farm. The soil is really the farmer's working capital—capital which, obviously, we cannot afford to squander.

Restoring Life to the Landscape.

WHEN we come to think of it, soil destruction and wild life destruction were born of the same process. In our pioneering zeal and enthusiasm we, in many cases, cleared every stick of timber off our land, either with the axe or firestick, and in many other ways disturbed the balance of nature by unwise or injudicious or thoughtless exploitation. As for wild life—especially valuable native insect-eating birds—by chopping down or ringbarking heedlessly every tree, we destroyed their feeding and breeding places, and so made easy the multiplication of insect pests, blowflies, grasshoppers, and the like, which to-day are costing the man on the land millions in hard cash every year. Fortunately, it is repeated, we are waking up to all these things, and are applying more intelligence and judgment in the development or proper use of our land heritage, and where it has been lost, we are "restoring life to the landscape." After all, the wealth of Australia is rooted in the soil, and it is our job to see that that wealth is not lost by stealth—the stealth of wind and water uncontrolled. We can no longer stand idly by while our farms go down the creek by instalments during every heavy shower of rain.

Grow More Cotton.

MORE cotton is a war-time necessity and, unlike butter, sugar, and wheat, and other crops of which we grow an exportable surplus, cotton-growing has points about it that appeal to every farmer, and they are a guaranteed price and a guaranteed market. The market is guaranteed in so far as our present production falls far short of the supply required by Australian spinning mills. Farmers in the recognised cotton districts, of course, know all this, but, in many cases, the difficulty is sufficient soil moisture to ensure a crop. A guaranteed market is all right, but they naturally ask what about a guaranteed crop? In answer to that, the Queensland Government is ready to help a farmer with suitable cotton country to get an irrigation outfit and install it for him. The cost is kept down to the lowest limit possible. There are no overhead charges to pay and the price of the outfit is the actual cost, plus the cost of transport and installation. The money for buying the plant is lent without interest and repayment is spread over ten years—it is really a charge against the annual crop. The only other security required is in the irrigation outfit itself. In return, a farmer is required to grow and irrigate about 10 acres of cotton every year. He must, of course, have enough water for irrigation and his own power plant—tractor or otherwise. After providing for the cotton crop, a farmer may, of course, use his irrigation outfit for watering any other crop.

To any farmer interested, the Bureau of Rural Development, Brisbane, will send full particulars. The big thing is to grow more cotton as a war-time necessity.

The Establishment of a Home-made Cuprous Oxide Mixture as a Citrus Fungicide in Southern Queensland.

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THE problem of disease control in citrus orchards in Queensland has become increasingly serious as the development of the industry necessitated more and more attention being given to efficiency in production. The four most important diseases with which growers have to contend are black spot (*Phoma citricarpa* McAlp.), melanose (*Diaporthe citri* (Faw.) Wolf), scab (*Sphaceloma fawcettii scabiosa* Jenkins) and brown spot of the Emperor of Canton mandarin (*Gloeosporium* sp.). These have proved amenable to fungicidal spray schedules involving the application of Bordeaux mixture with or without supplements. Orchardists, however, have been loth to use this spray, claiming that severe adverse effects to the trees follow its application.

The unpopularity of Bordeaux mixture was emphasized in the case of brown spot as fungicidal treatment was necessary even more than for the other diseases mentioned. When this disease was first recorded from Queensland, Bordeaux mixture was recommended for its control but growers had little success with the spray. An investigation into the control of the disease was accordingly commenced in 1931 (Mandelson and Blackford 1938), but the work had not proceeded very far before it became evident that serious disadvantages were associated with the use of Bordeaux mixture. In an attempt to find a substitute for this spray various mixtures were tried out. The one showing the most promise of value was prepared from bluestone, molasses and caustic soda, according to a formula which had proved successful in controlling blue mould in tobacco seedlings (Mandelson 1933). Mandelson and Blackford (1938) showed that this mixture was quite satisfactory for the control of brown spot and that its use seemed to be unattended by complications which usually followed applications of Bordeaux mixture. Following this initial success, further investigations were carried out by the author with a view to obtaining a reliable estimate of the value of home-made cuprous oxide mixture as a standard spray for inclusion in an orchard pest and disease control programme. This involves the consideration of three aspects of the use of the spray, viz.:—

(1) the phytocidal effects of the spray;
(2) the fungicidal effects;
(3) the interaction of copper sprays with various materials used for pest control.

These three aspects form the main consideration of the present paper.

MATERIALS AND METHODS.

All the field experiments reported here were carried out with citrus trees kindly placed at the disposal of the Department by orchardists in the various districts. Unless otherwise stated, all sprays for the control of insect pests and mites were chosen and applied at the discretion of the orchardist. Cultivation, pruning and manuring were also carried out according to his normal programme.

Throughout the work the randomised block type of layout was used, a single tree representing a plot. Where the interaction between treatments was investigated, for example in copper spray fumigation experiments, the split plot layout was adopted.

Materials sold as commercial spray ingredients were used to prepare the various mixtures. In the case of Bordeaux mixture, hydrated lime of a good quality was used in all cases. In applying the sprays, use was made of the power outfit in the possession of the orchardist, the pumps delivering the spray at a pressure of approximately 150-200 lb. per square inch. Spray rods at least six feet long were used, the nozzles delivering a fine mist which was comfortably applied to the tops of the trees.

For the purposes of fumigation, medium weight calico sheets were used. A commercial form of calcium cyanide in the form of a fine dust, was the fumigant, the charge being scattered under the tent by hand. Dosages of the fumigant were determined by measuring the height and diameter of the tree and then referring to the dosage chart supplied by the manufacturers. The period of fumigation was 45 minutes.

In taking leaf samples for the estimation of the spray residue, fifty leaves from the outer canopy were selected at random from points round the tree at shoulder height. Leaves fully expanded at the time of spraying and approximately the same age were chosen to avoid the error introduced by the growth of the lamina after spraying. Discs, approximately 1.6 cm. in diameter were punched from the centre of the leaves. This eliminated the heavy concentrations of spray residue often found at the tip and stalk ends of the lamina. One disc from each of the fifty leaves was taken for estimation, the leaf surface, both sides included, being approximately 200 sq. cm.

The estimations of copper in the spray residue were made by Mr. J. L. Foran, of the Agricultural Chemist's Branch, according to the method outlined by Hoar (1937). Both the pyrophosphate and citrate methods were used, consistent results being obtained. At the outset, wet oxidation with a mixture of nitric and sulphuric acids was employed. Similar results were obtained by the dry ashing (without flame) process, so that use was made of this method for the majority of the determinations, a good white to grey ash being obtained in all cases.

CHEMICAL COMPOSITION OF THE SPRAY.

The spray mixture used in the series of experiments described in this paper is similar to that recommended by Mandelson (1933) for the control of blue mould of tobacco seedlings. The formula is a slight modification of that suggested by Raleigh (1933) for the control of Irish blight of potatoes. The method of preparation of the mixture involves the use of two solutions.

Solution A.

1 lb. bluestone (copper sulphate, pentahydrate).

1 pint molasses.

4 pints water.

Solution B.

5 oz. caustic soda.

3 pints water.

Solution B is poured slowly into solution A, stirring vigorously until thoroughly mixed. A heavy precipitate, at first dirty green in colour, is formed. On allowing the mixture to stand—usually ten days to a fortnight is necessary—the colour of the precipitate changes to brownish yellow. For use this stock solution was diluted to the strength required, usually 3 gallons in 40 gallons.

When caustic soda is added to copper sulphate so as to obtain a neutral solution, a pale-blue precipitate of cupric hydroxide is formed. In two to three hours, this precipitate decomposes to the black cupric oxide. The addition of glucose to the copper sulphate solution before the caustic soda is mixed with it prevents this rapid decomposition. In this case, the precipitate when first formed has a greenish tinge and slowly changes to a yellow cuprous oxide similar in appearance to that obtained when molasses is used. This change usually requires ten to fourteen days.

If the mixture is allowed to stand for a further fortnight it is found that much of the cuprous oxide has been redissolved to give a greenish-blue solution. Coincident with an increase in the amount of soluble copper is an increase in the hydrogen ion concentration, mixtures at first neutral becoming acid. The addition of caustic soda to this solution reprecipitates cuprous oxide.

Qualitative tests have shown this soluble copper to be in an organic form. Its value as a fungicide is unknown. It probably does not remain in the soluble form on the leaf as it has been shown that on clean microscope slides it changes to yellow insoluble cuprous oxide on drying. It has also been shown that this soluble form of copper may be eliminated by slightly modifying the formula and using honey instead of molasses as a source of reducing sugars. A little more caustic soda is added, just sufficient to neutralise the acid oxidation products of the glucose. Also, the variation in the content of reducing sugars is less in honey than in molasses, so that the theoretical amount of reducing sugars necessary for use in the mixture can be more closely approximated.

The most suitable proportions of the various materials used when honey is the source of reducing sugars in the formula have not been fully determined. The following has much to commend it:—

Solution A.

9 lb. bluestone.

5 gallons water.

Solution B.

3 lb. caustic soda.

1 pint honey (70-75 per cent. reducing sugars).

4 gallons water.

This formula makes up 9 gallons of stock solution which may be used at the same strengths as previously recommended for the molasses mixture.

A comparison of the cost of cuprous oxide mixture and that of Bordeaux shows very little difference. Taking current prices for materials, the cost of 40 gallons of spray would be—

	s.	*d.*
Bordeaux mixture, 3-2-40	1	1½
Cuprous oxide mixture, molasses formula (3-40)	1	5½
Cuprous oxide mixture, honey formula (3-40) ..	1	5½

From the above discussion it is evident that copper is present in the spray mainly, and perhaps wholly, as cuprous oxide, and, from general observations it would appear that it is not present as a true colloid. Hence the term "home made cuprous oxide mixture" more appropriately describes the spray than "colloidal copper."

COMPARISON OF THE PHYTOCIDAL EFFECTS OF BORDEAUX AND HOME-MADE CUPROUS OXIDE MIXTURES.

Although Bordeaux mixture has held pride of place as a fungicide for many years, there have, of late, been many reports of plants being adversely affected by this spray. This is particularly the case in respect to citrus. In Florida it was found (Rhoads 1929, Winston, Bowman and Bach 1927) that when Bordeaux mixture was applied early in the season for the control of melanose, an increase in scale infestation of the trees resulted. It was considered that this was due to the effect of the fungicide on the entomogenous fungi which otherwise exert some degree of control of these pests. Fawcett (1936) described a slowly appearing type of injury which followed applications of Bordeaux mixture in summer. The injury was not permanent, trees on recovery seeming to be slightly more vigorous than before. McCleery (1939) in New South Wales described serious chronic injury following the use of Bordeaux mixtures of 6-6-50 and 6-6-80 strengths. This injury was found particularly in orchards in which the trees were in a condition of poor growth. The fruit was reduced in size, the texture of the rind was poor, and the colour at maturity inferior. The growth of the trees was hardened and the trees showed an increased tendency to leaf fall. Associated with these adverse effects on the health of the trees was a marked increase in scale infestation.

In early experiments with Bordeaux mixture of 4-4-40 strength in Queensland, Mandelson (unpublished report) noted this effect on the growth and vigour of the trees, together with the increased scale infestation and the deterioration of fruit quality. This injury was more marked the later in the season the spray was applied. In later experiments (Mandelson and Blackford 1938), similar though less apparent injury followed the use of 3-2-40 Bordeaux mixture in a four-spray schedule. However, four sprays of home-made cuprous oxide mixture used under identical conditions did not show the same detrimental effects. A direct comparison along these lines between the effect of this fungicide and Bordeaux mixture was then thought necessary. Experiments to obtain information on the effect of copper sprays on red scale infestation were carried out in the 1937-38 and 1938-39 seasons.

Experiment 1 (1937-38).

In an experiment designed primarily to investigate the compatibility of various scalicides with cuprous oxide and Bordeaux mixtures,

some of the trees were not sprayed with a scalicide until late in the season and others received no scalicide at all. Just prior to the application of the scalicide, estimations of the scale infestations of the trees were made.

The treatments compared were—

Treatment A. Cuprous oxide mixture (3-40), applied in late September, late November, and late February.

Treatment B. Bordeaux mixture (3-2-40), applied in late September and late November, and cuprous oxide mixture (3-40), applied in late February.

Treatment C. No sprays.

In estimating the density of the scale population, counts of the number of scales on five twigs of similar size, selected at random from the trees, were made, together with similar counts on five fruit, also selected at random. These counts are shown in Table I.

TABLE I.

COUNTS OF SCALE INSECTS ON TWIGS AND FRUIT, 1937–38 EXPERIMENT.

Treatment.	Block 1.			Block 2.			Block 3.			Block 4.		
	Twigs.	Fruit.	Total.	Twigs.	Fruit.	Total.	Twigs.	Fruit.	Total.	Twigs.	Fruit.	Total.
A ..	2	72	74	69	1,020	1,089	34	10	44	46	916	962
B ..	264	289	553	98	2,644	2,742	65	802	867	38	1,939	1,977
C	81	568	649	49	604	653	131	51	182	60	377	437

These results are very variable, but there is some indication that the cuprous oxide mixture did not increase the density of the scale population to the extent that Bordeaux mixture did.

Experiment 2 (1938-39).

In this season an experiment was set out in the Howard district using Late Valencia orange trees. Two spray schedules consisting of (*a*) three applications of cuprous oxide mixture (3-40), and (*b*) three applications of Bordeaux mixture (3-2-40) were compared, unsprayed trees being included as controls. At the request of the orchardist, just prior to the application of the copper sprays the trees were sprayed with white oil (1-40) to reduce scale infestation to a minimum, but no further scalicides were applied to the trees until all figures relating to scale infestation were obtained. Twenty-four trees were included in the experiment, the layout of which conformed to that of a randomised block of three treatments with eight replications.

Approximately three months after the third application of the fungicides, an estimation of the scale populations of the trees was obtained. First, a comparison between the density of the scale infestation of fruit from the trees in each block was made. In six of the blocks these showed a slight increase on trees receiving Bordeaux mixture and cuprous oxide mixture, though no differences between the respective

sprays could be detected. Of the other two blocks, one showed no difference between the plots, and in the other the tree sprayed with Bordeaux mixture showed a more dense infestation than either the tree sprayed with cuprous oxide mixture or the control.

Subsequently, 100 fruit were selected at random at shoulder height from all sides of each tree and classified as clean or scale infested. The percentage of scale infested fruit averaged out at 47 for the trees sprayed with Bordeaux mixture, 41 for those receiving cuprous oxide mixture, and 21 for the controls.

In this experiment, therefore, cuprous oxide mixture increased scale infestation almost as much as did Bordeaux mixture. However, the infestation over the whole plot was light, and though the differences between the scale populations on sprayed and control trees were noticeable, these were very small. The trees included in the experiment were in vigorous healthy growth when the sprays were applied, and it is probable that greater differential effects would have been obtained if weaker trees had been used.

Apart from the scale infestation, no adverse effects on the fruit or the growth of the trees were noted on the trees sprayed with either Bordeaux mixture (3-2-40) or cuprous oxide mixture (3-40). This statement holds for all cases where no more than one season's application of three sprays has been made. Past experience suggests that Bordeaux mixture even at this strength would not be so free from blame if the applications were repeated in successive seasons. On the other hand, in a small area of mandarin trees used in experiments for the control of brown spot, certain trees have been receiving at least three and sometimes four applications of cuprous oxide mixture (3-40) each season for five successive years without any adverse effects appearing. In fact, the growth of the trees seems to show improvement, though this may be attributed to the control of the leaf and twig infections of the disease. Reports from orchardists in various districts who have used the spray all confirm this lack of injurious effects, and cuprous oxide mixture has achieved considerable popularity on this account.

Recent work carried out by Horsfall (1938, 1939) and his collaborators throws some light on this phase of the use of cuprous oxide mixture. From their investigations of the injurious effects of Bordeaux mixture on tomatoes and cucurbits, they came to certain conclusions—

(1) Injury increases with increase in spray load.

(2) At pH 7, approximately, least injury occurs, the amount increasing with increasing acidity (immediate burning following the use of an insufficiently neutralised mixture) or alkalinity.

(3) Hydrated lime has an adverse effect on plant growth when used in a spray.

The injury mainly considered was the chronic type, including dwarfing, leaf curling, and hardening, rather than the acute type which occurs when insufficiently neutralised sprays are used. It is the former type which is also the most serious concern in the use of fungicides for citrus disease control.

Considering cuprous oxide mixture from these aspects there is first the question of spray load. Spray load is defined as the amount of material applied to a leaf, and for the sake of comparison a convenient

figure is obtained by summing up the weights of the constituents of the spray. Thus the figure for Bordeaux mixture (3-2-40) is 5 lb. per 40 gallons. In the same way the spray load for cuprous oxide mixture (3-40) would be 4 lb. (approximately) to 40 gallons, i.e., less than the Bordeaux mixture of the same copper content. However, it must be pointed out that all the material in the Bordeaux mixture is insoluble in water, whilst it is only the cuprous oxide which remains insoluble in the cuprous oxide mixture; the rest, sodium sulphate and various organic compounds from the molasses, are soluble. The greater part of these soluble compounds would be removed by the first shower of rain, so that a true figure for the spray load for this mixture would be slightly less than 1 lb. per 40 gallons. Thus the cuprous oxide mixture has only one-fifth the effective spray load of the Bordeaux mixture of the same copper concentration. In the light of overseas work it would be natural to expect a considerable reduction in injury from the cuprous oxide mixture on this score.

It is well known that trees growing near dusty roads or frequently used driveways in the orchard, where they become coated with a heavy dust layer, comparable with a heavy spray load, are less vigorous than trees further removed from the source of the dust. Scale infestation is heavier and dieback and hardening of the growth are found, symptoms similar to those associated with the use of Bordeaux mixture.

Regarding the pH of the spray, the formula for the cuprous oxide mixture has been so calculated as to provide a spray as near to neutral as possible. In correspondence with the writer, Mr. F. C. McCleery, of the New South Wales Department of Agriculture, reported that cuprous oxide mixture made up according to the formula suggested by Raleigh (1933) caused severe injury to the bark of terminal twigs and fruit of Late Valencia orange trees when three or four applications were made. It is interesting to note that in similar experiments under Queensland conditions three applications of the neutral mixture to Late Valencia orange trees in the Howard district caused no injury of this type in two different seasons. The mixture suggested by Raleigh (1933) contains 6·4 oz. of caustic soda per lb. of bluestone, which is 1·4 oz. in excess. Although the climate, district, and vigour of the trees must be considered also, this difference between the injury caused by the neutral and alkaline sprays is noteworthy.

A reduction in the concentration of the lime in the mixture may account in part for the reduction of injury caused by 3-2-40 Bordeaux mixture when compared with the 4-4-40 strength. The elimination of the calcium hydroxide entirely from the spray formula must be considered a factor in the reduction of injury when cuprous oxide mixture is used. Calcium is present in the molasses, but it is in the form of salts which are not considered harmful.

FUNGICIDAL VALUE OF CUPROUS OXIDE MIXTURE.

The first recorded use of sugar as a supplement for copper sprays is that by Perret (1892). Part of the copper was converted to the soluble copper saccharate, which he claimed increased the fungicidal value of the original Bordeaux mixture. Good results were obtained with the control of disease and the mixture was harmless to the plant. Barth (1925) also found this combination superior to Bordeaux mixture for the control of mildew. Doran (1923) reported that the addition of

4 lb. of sugar increased the toxicity of Bordeaux mixture (4-2-50) to spores of *Venturia inaequalis* four times, Perret's formula being only twice as effective.

Barth (1925) used molasses as a source of sugar in Perret's mixture without affecting its efficiency in any way. Holland, Dunbar, and Gilligan (1929) pointed out that the reducing sugars present in molasses would convert some of the copper compounds to cuprous oxide, then regarded as an inferior fungicide.

The first detailed investigation of the fungicidal value of cuprous oxide was made in 1932 by Horsfall, who used it successfully as a seed dust for combating damping off. This work was continued further, the material being used as a spray, which provided good control of several foliage diseases (Horsfall, James, and Suit, 1938). These results have since been confirmed by others.

In a comparison between the fungicidal properties of cuprous and cupric oxides it was found (Anderson, Kadow, and Hopperstead, 1937) that cuprous oxide was somewhat superior to cupric oxide as a seed treatment for the control of damping off. Rather varying results were obtained (Marsh, Martin, and Munson, 1937) in a comparison of these two materials for the control of potato blight. Further investigation (Horsfall, Marsh, and Martin, 1937) showed that the fungicidal properties of cuprous oxide were profoundly modified by variation in particle size—the smaller the particle size the greater the fungicidal activity. Heuberger and Horsfall (1939) have since shown that the colour of cuprous oxide is a good indication of particle size, the yellow having the smallest and red the largest. The fungicidal activity decreased as the colour changed from yellow to red. They place the type of spray discussed in this paper at the yellow end of the series.

There has been very little work done in connection with the use of cuprous oxide as a fungicide to replace Bordeaux mixture. Laboratory investigations by McCallan and Wilcoxin (1938) of the toxicity of sprays to germinating spores led them to believe that Bordeaux mixture was slightly superior to cuprous oxide. Kuntz (1938) reports some success with a cuprous oxide spray for the control of melanose and scab of citrus in Florida. Cuprous oxide was first used for the control of a citrus disease in Queensland in 1933-34 by Mandelson and Blackford (1938) when it was included in experiments for the control of brown spot. It was used again the following year—not so much on account of any outstanding fungicidal efficiency shown but because of its favourable comparison with Bordeaux as regards its phytocidal effects. This time there were indications that cuprous oxide mixture (3-40) was as efficient a fungicide as Bordeaux mixture of the same copper content. A third experiment introduced a three-spray schedule, which proved successful in controlling the disease. This is of particular importance in connection with cuprous oxide mixture, since, as will be shown later, it makes possible fungicide-scalicide combinations.

Observations made while counting the fruit from these experiments suggested that black-spot infection was also being reduced by the applications of cuprous oxide mixture. As this spray showed promise of possessing advantages not found in Bordeaux mixture, an investigation of its efficiency as a fungicide for the control of important citrus diseases other than brown spot was considered necessary. This was accordingly done, and the results obtained with respect to the different diseases will now be discussed in turn.

BROWN SPOT.

The earlier work in the control of this disease with cuprous oxide mixture has already been discussed (Mandelson and Blackford, 1938). The accumulated results showed that this spray applied at half blossom fall, eight weeks later and in late February was effective in controlling the disease. In the 1937-38 season a final comparison was made between cuprous oxide and Bordeaux mixtures.

The experiment was set out primarily to investigate the effects of the application of various scalicides applied after cuprous oxide sprays. However, as it also served as a means of comparison between cuprous oxide and Bordeaux mixtures, the matters having relation to this question will be discussed here.

The three-spray schedule developed previously was used. The fungicidal treatments were—

Treatment A. Three applications of cuprous oxide mixture (3-40).

Treatment B. Two applications of Bordeaux mixture (3-2-40), followed by an application of cuprous oxide mixture (3-40).

Treatment C. Controls—no fungicidal sprays.

Cuprous oxide mixture was used as the third spray in treatment B, as it was considered best to avoid the possibility of adverse phytocidal effects following a third application of Bordeaux mixture. Scalicide treatments are discussed later under the section dealing with compatability of sprays.

Thirty trees were included in the experiment and these were divided into ten blocks, the experimental layout conforming to that of a randomised block of three treatments with ten replications.

At picking time counts of diseased and healthy fruit, including fallen fruit, were made in the same way as in the previous experiments. The results are shown in Table II.

TABLE II.

BROWN SPOT EXPERIMENT, 1937-38—PERCENTAGE OF DISEASED FRUIT PER PLOT.

Treatment.	Blocks.										Average.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	
Cuprous oxide mixture (three sprays) ..	4·4	5·1	2·5	3·3	6·4	4·3	4·2	4·0	6·0	2·4	4·3
Bordeaux mixture (two sprays)+ cuprous oxide mixture (one spray) ..	5·0	2·5	2·9	4·3	7·4	4·0	3·3	4·9	5·3	7·0	4·7
Controls (no sprays) ..	22·4	10·6	15·4	23·3	14·2	18·2	12·9	15·2	26·0	8·3	16·6

From these results the following conclusions may be drawn:—

(1) Cuprous oxide mixture is as effective for the control of brown spot as Bordeaux mixture of the same copper content (i.e., 3 lb. copper sulphate to 40 gallons).

(2) The three-spray schedule provides effective control of the disease.

BLACK SPOT.

The spray schedule previously recommended for the control of black spot consisted of two applications of Bordeaux mixture 3-2-40 at (*a*) half to three-quarters petal fall, and (*b*) six to eight weeks later. Under Queensland conditions it has been shown in field experiments carried out by Mandelson (1933) that although the fruit is susceptible to infection at all times from setting to picking, this schedule will provide good control of the disease even in areas of very heavy rainfall such as is met with on the Blackall Range at Mapleton. However, few orchardists availed themselves of this method of control and investigations of the effectiveness of cuprous oxide mixture were commenced in the hope that a more appreciated measure would be available.

Experiment 1 (1937-38).

The first experiment was carried out in the Howard district using Late Valencia orange trees. Cuprous oxide mixture (3-40) was compared with Bordeaux mixture (3-2-40) in a two-spray schedule. As cuprous oxide mixture does not adhere as well as Bordeaux, it was considered that a third spray of this mixture might be necessary to ensure a sufficient cover after washing by rain. Accordingly a third application, corresponding with the third application in the brown spot control schedule was included. The spray schedules used are shown in Table III.

TABLE III.

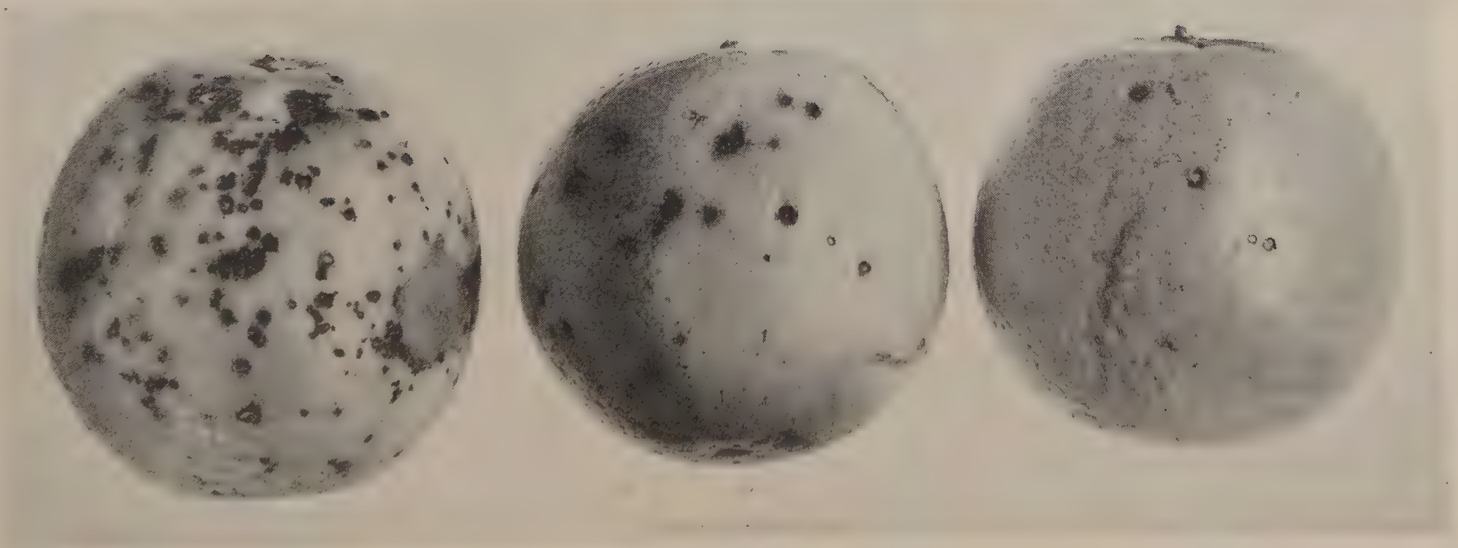
Black Spot Experiment, 1937-38—Spray Schedules.

Treatment.	Late September.	Late November.	Late February.
A	Cuprous oxide	Cuprous oxide	Cuprous oxide
B	Bordeaux	Bordeaux	..
C	Cuprous oxide	Cuprous oxide	..
D	..	Controls, no fungicidal spray	

Twenty trees were available for the experiment, and these were divided into five blocks, the layout conforming to that of a randomised block of four treatments with five replications.

At picking time the diseased fruit were separated and classified into three grades of infection. Plate 1 illustrates the method of grading for degree of infection, A being a typical severely infected fruit, B and C being the greatest amount of infection permitted in the moderately and slightly infected grades respectively.

The figures for these counts are shown in Table IV. For the purpose of summary and analysis the slightly infected fruit were included with the healthy, the other two grades being combined as diseased.



A B C

Plate 1.

BLACK SPOT.—Degrees of Infection.

A. Typical severely infected fruit.
B. Greatest amount of infection permitted in moderately infected grade.
C. Greatest amount of infection permitted in slightly infected grade.

TABLE IV.

FRUIT COUNTS, 1937-38—BLACK SPOT EXPERIMENT.

Treatment.	Healthy.	Diseased.			Total Healthy.	Total Diseased.	Percentage.	
		Slight.	Moderate.	Severe.				
A	650	..	..	..	650	..	..	
A	684	2	6	3	686	9	1·3	
A	1,044	6	4	..	1,050	4	0·4	·7
A	960	4	7	3	964	10	1·0	
A	882	4	2	5	886	7	0·8	
B	1,100	1	..	..	1,101	..	..	
B	950	2	1	..	952	1	0·1	
B	835	3	3	..	838	3	0·4	·3
B	756	1	1	3	757	4	0·5	
B	791	8	..	5	799	5	0·6	
C	674	10	..	3	684	3	0·4	
C	834	10	10	5	844	15	1·7	
C	433	..	..	2	433	2	0·5	·7
C	721	2	..	2	723	2	0·3	
C	832	14	2	5	846	7	0·8	
D	656	26	15	3	682	18	2·6	
D	863	26	59	71	889	130	12·8	
D	1,058	30	42	36	1,088	78	6·7	8·2
D	826	25	54	45	851	99	10·4	
D	900	56	56	32	956	88	8·4	

The results of this experiment suggest the following conclusions:—

(1) Cuprous oxide mixture is as effective for the control of black spot as Bordeaux mixture of the same copper content (3 lb. bluestone to 40 gallons).

(2) Under the conditions of the experiment, the third application in treatment A was not necessary. As very heavy rainfall was experienced after the application of the second spray the conditions may be considered as a severe test of the value of the third application.

Trees adjacent to those included in the experiment received one application of cuprous oxide mixture (3-40) as part of the orchard routine. This spray was applied at the same time as the first spray in the experiment, i.e., at half to three-quarters petal fall. While no counts were taken, it was observed that there were nearly as many diseased fruit on these trees as on the unsprayed trees in the experiment. Rainfall figures show that December and January were wet months. The cover supplied by the first spray lasted for October and November but was not sufficient for December and January, the second spray being necessary to prevent infection in these two months.

Experiment 2 (1938-39).

In a trial set out at Woombye primarily for the investigation of the control of melanose some information was obtained with respect to the control of black spot. Orange trees of the Sabina variety were used.

The details of the spray schedules used are shown in Table V. In all schedules except E one application only was made, and this when

half to three-quarters of the petals had fallen. In treatment E a second application was made two months later, as in the usual black spot control programme.

At picking time the fruit was classified and counted as in the previous experiment. The results of these counts are shown in Table V.

TABLE V.

BLACK SPOT EXPERIMENT, 1938-39—PERCENTAGE OF MODERATELY AND SEVERELY DISEASED FRUIT.

Treatments.	Blocks.				Average.
	1.	2.	3.	4.	
A Cuprous oxide mixture (3–40)	2·1	5·3	2·7	3·1	3·3
B Cuprous oxide mixture (3–40 + Agral 2) ..	3·7	4·1	2·1	0·9	2·7
C Cuprous oxide mixture (3–80)	2·9	1·7	3·6	3·2	2·8
D Commercial cuprous oxide	4·8	2·0	2·0	1·3	2·5
E Two sprays cuprous oxide mixture (3–40)	2·1	1·2	1·6	0·8	1·4
F Bordeaux mixture (3–2–40)	1·6	0·4	3·1	2·5	1·9
G Controls	7·6	7·2	12·5	9·9	9·3

Necessary difference for significance = 2·2.

The above results suggest that—

(1) Both the home-made and commercially prepared cuprous oxide mixtures were as effective as Bordeaux mixture of the same copper content.

(2) The addition of a spreader, Agral 2, did not improve the efficiency of the cuprous oxide mixture in any way.

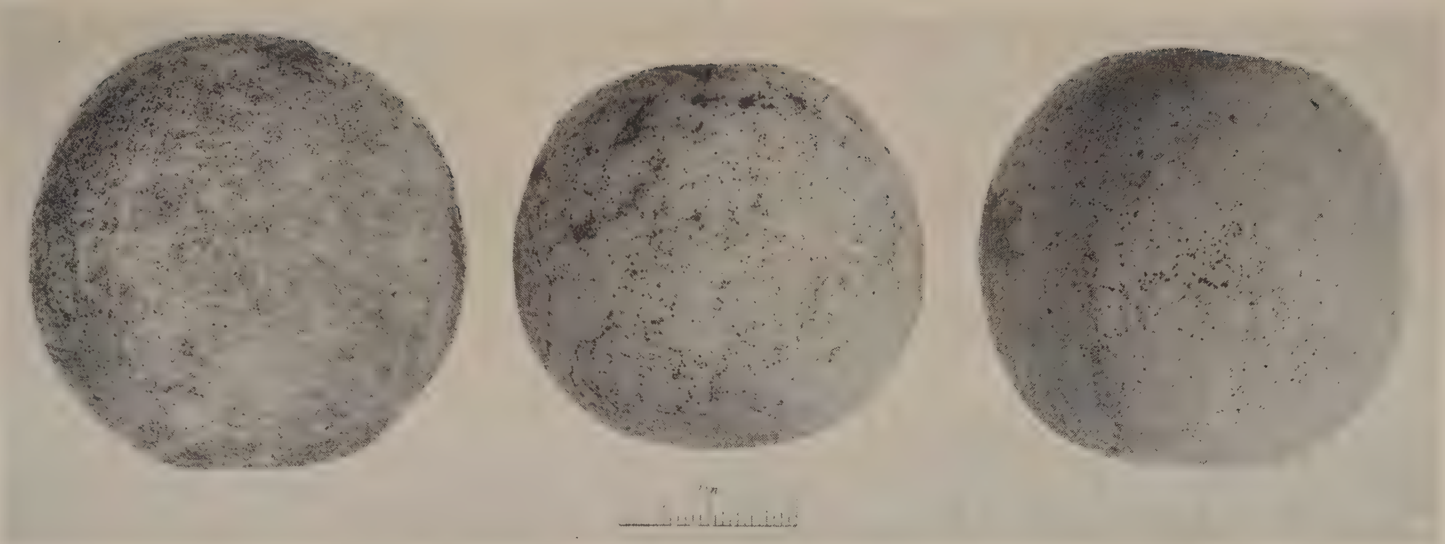
(3) The 3-80 strength cuprous oxide mixture was as effective as the 3-40 strength previously used.

(4) For this season the second application was not warranted. An examination of the figures for December and January shows that the rainfall was very low—104 and 392 points respectively—as a contrast with that in the Howard experiment, where the figures were much higher, with more days suitable for infection to take place.

MELANOSE.

Melanose and scab on tangelos are the two citrus diseases present in America, for the control of which cuprous oxide has been used. Kuntz (1938) used cuprous oxide (1-100) together with lethane and cotton-seed oil and found it slightly superior to 3-3-100 Bordeaux mixture for the control of melanose.

The only investigation of the use of cuprous oxide for the control of melanose in Queensland was carried out at Woombye in the 1938-39 season. This experiment has already been outlined on page 15 in the section dealing with black spot. The spray schedules are given in Table V. Agral 2, a proprietary spreader, was added to the mixture



A B C

Plate 2.

MELANOSE.—Degrees of Infection.

A. Typical severely infected fruit.
B. Greatest amount of infection permitted in moderately infected grade.
C. Greatest amount of infection permitted in slightly infected grade.

in treatment B at the rate of 3 oz. to 40 gallons, twice the amount recommended by the manufacturers for use with Bordeaux mixture. The proprietary line of cuprous oxide used in treatment D is sold mixed with a spreader and sticker in the form of a powder which mixes readily with water, giving a spray which spreads evenly and adheres very well. As the powder contains 50 per cent. copper as cuprous oxide it was used at the rate of 1½ lb. to 40 gallons, giving a suspension of the same copper concentration as cuprous oxide mixture 3-40.

At picking time the fruit was classified and counted in a manner similar to that used when dealing with black spot. Fruit standards similar to those used to determine the degree of infection of black spot are illustrated in Plate 2. For the purpose of analysis the counts were also treated in a manner similar to that used in the black spot experiments. The figures are shown in Table VI.

TABLE VI.

MELANOSE EXPERIMENT, 1938-39—PERCENTAGE OF MODERATELY AND SEVERELY DISEASED FRUIT.

Treatments.	Blocks.				Average.
	1.	2.	3.	4.	
Cuprous oxide mixture (3–40)	nil	2·1	2·5	6·5	2·8
Cuprous oxide mixture (3–40 + Agral 2) ..	4·9	2·2	4·8	1·9	3·5
Cuprous oxide mixture (3–80)	5·6	5·5	2·7	5·5	4·8
Commercial cuprous oxide	2·0	7·2	0·7	0·6	2·6
Two sprays cuprous oxide mixture (3–40) ..	0·3	0·3	0·5	3·9	1·3
Bordeaux mixture (3–2–40)	nil	7·8	1·7	nil	2·4
Controls	26·4	14·0	21·3	15·4	19·3

Necessary difference for significance = 5·1.

From these results it may be concluded that—

(1) Home-made cuprous oxide and the commercial form are as effective as Bordeaux mixture for the control of melanose.

(2) The addition of Agral 2 as a spreader does not increase the efficiency of the home-made mixture in any way.

(3) The second application gives no additional control of melanose. Apart from the lack of rainfall suitable for infection in December and January, Burger (1923) has shown that a fruit is immune to infection by the melanose fungus six to eight weeks after setting.

(4) The dilution of the cuprous oxide mixture to the 3-80 strength did not decrease its fungicidal value to a noticeable extent.

SCAB.

No investigations of the value of home-made cuprous oxide mixture for the control of scab have been conducted in Queensland. Kuntz (1938), as mentioned previously, found that 1-100 cuprous oxide plus lethane and cottonseed oil was effective for a similar disease on tangelos

in America. In Queensland the disease, though severe in its effect on lemons and mandarins, is of rather rare occurrence in well conducted orchards. In a few cases it has appeared and observations showed that it could be kept in check with one application of cuprous oxide mixture 3-40 at half to three-quarters petal fall.

CONCLUSION.

From the foregoing descriptions of experiments and observations carried out in various citrus districts, it is evident that home-made cuprous oxide of a strength 3-40 is equivalent to a Bordeaux mixture (3-2-40), i.e., of the same copper content, for the control of brown spot, black spot, melanose, and scab. The 3-80 strength of cuprous oxide, i.e., half the copper content of the standard Bordeaux mixture, although used in only one season, then provided an effective control for both black spot and melanose. In a previous experiment with brown spot it was found to be of some value, and further investigation of the use of this strength would be worth while.

Apart from its fungicidal value the cuprous oxide mixture possesses definite advantages as a citrus spray, and since its efficiency is now proved it can confidently be recommended as a substitute for Bordeaux mixture. The fungicidal schedules now suggested for the control of brown spot, black spot, melanose, and scab in Southern Queensland may be set out as shown in Table VII.

TABLE VII.

Fungicidal Spray Schedules for Southern Queensland.

Disease.	Late September. (¼ to ¾ petal fall.)	Late November.	Late February.
Brown spot ..	Cuprous oxide mixture (3–40)	Cuprous oxide mixture (3–40)	Cuprous oxide mixture (3–40)
Black spot ..	Cuprous oxide mixture (3–40)	Cuprous oxide mixture (3–40)	..
Melanose ..	Cuprous oxide mixture (3–40)	..	..
Scab	Cuprous oxide mixture (3–40)	..	..

The 3-40 strength (3 gallons of stock in 40 gallons of water) is recommended, as there is not sufficient experimental evidence in favour of the 3-80 dilution.

The date of application of the late September spray may vary from mid-September to early October, depending on the state of the blossom. The late November spray may be varied accordingly from mid-November to early December, similar remarks applying to the late February spray.

COMPATIBILITY OF FUNGICIDAL AND INSECTICIDAL TREATMENTS.

The spray schedules recommended above for Southern Queensland citrus orchards provide for one, two, or three fungicidal applications through the spring and summer months. The trees may be also infested with various pests, such as scale insects, maori mite (*Phyllocoptes oleivorus* Ashm.) and the larger horned citrus bug

(*Biprorulus bibax* Bred.). The presence of such pests necessitates control measures which may involve fumigation or spraying at one or more times during the season. The fitting-in of a fungicidal programme with an insecticidal programme presents many difficulties, as the question of compatibility of treatments must be considered. The possibility of combining sprays, thereby reducing labour costs and saving time, must also be borne in mind.

For the purpose of the discussion of the compatibility of fungicidal and insecticidal treatments, the citrus districts of Southern Queensland may be broadly classified into two divisions—

(1) Inland districts, such as Gayndah, where the general practice is to fumigate for the control of insect pests.

(2) Coastal districts, such as Burrum, where the general practice is to spray for the same purpose.

In addition, in both divisions lime sulphur or sulphur dust, zinc sulphate and nicotine sulphate sprays may find a place in the spray programme.

Where spraying is practised for the control of pests, recourse must be made to several applications of different mixtures during the season to obtain a reasonable degree of control. The question, then, of interaction between such sprays and the residue of copper sprays on the trees and *vice versa* is very important. The compatibility and possible combinations of the various sprays with cuprous oxide mixture will be discussed under the headings of the sprays concerned. The association of copper sprays and fumigation injury is well known, and this question will be discussed in a final section on fumigation.

SCALICIDES.

For the control of certain citrus scale insects in Queensland, Summerville (1934) recommends various mixtures, chief of which are—

(1) Soap-washing soda.

(2) Soap-washing soda-white oil.

(3) White oil.

(4) Resin-caustic soda-fish oil.

These sprays have been applied at various times in the experimental work prior to applications of cuprous oxide mixture without any adverse effects to the tree. Applications have also been made following a copper spray without signs of injury. As a further check on this an experiment, partly described under the section dealing with brown spot, was set out in the 1937-38 season in which the above scalicides were applied within a week of the application of Bordeaux and cuprous oxide mixtures. No aggravation of injury was observed. The soap-washing soda mixture caused a small amount of leaf fall, but no differences were noticed where the copper sprays had been applied. Following the applications of the soap-washing soda-white oil, white oil and resin-caustic soda-fish oil sprays, three very hot days were experienced. These caused severe sunburn to exposed areas of the fruit (Emperor mandarins). The copper sprays did not seem to intensify this injury.

From the spray schedules used in the experiments for the control of brown spot and black spot, it was evident that there are possibilities

of combining two copper sprays with the scalicide applications, e.g., the late November fungicide for the control of brown spot and black spot may be combined with the early December scalicide for pink wax scale (*Ceroplastes rubens* Maskell), and the late February fungicide for the control of brown spot may be combined with the March scalicide for the control of the complex scale infestation on Emperor mandarins at this time. On investigation, it was found that when soap was added to the cuprous oxide mixture a thick curdy precipitate was formed. The formation of this precipitate was traced to the presence of calcium salts in the molasses. If cuprous oxide mixture is added to the soap-washing soda-white oil combination this curdy precipitate is again formed and the oil emulsion is broken. The curd is carried to the surface by the free oil and forms a thick, greasy scum, which is a useless obstruction, while the free oil is dangerous. It is possible that some redissolved copper compounds may also play a part in this reaction.

Experiments carried out with pure chemicals showed that a precipitate of cuprous oxide could be obtained by using glucose instead of molasses. This mixture was compatible with the soap-washing soda-white oil spray. A source of reducing sugars low in ash content as a substitute for molasses was then sought. Honey was chosen, as the ash content is less than 0·1 per cent. Cuprous oxide mixtures made up with honey were mixed with soap-washing soda-white oil without any adverse reactions taking place.

As the fungicidal schedule for the control of brown spot offers the best opportunity for the use of these combination sprays, an experiment was set out in the Howard district in the 1938-39 season using the schedules given in Table VIII. In making up the cuprous oxide mixture for combination with the scalicides, 1 pint of honey was used to 3 lb. of bluestone. The possibility of the reduction of this amount of honey has already been discussed.

TABLE VIII.

Brown Spot Experiment, 1938–39—Spray Schedules.

Time of Application.	Schedule A. (originally recommended).	Schedule B.	Schedule C. (no fungicides).
½ to ¾ petal fall	Cuprous oxide mixture (molasses formula 3–40)	Cuprous oxide mixture (molasses formula 3–40)	..
Mid November	Cuprous oxide mixture (molasses formula 3–40)	..	..
Late November	Soap—washing soda	Soap—washing soda + cuprous oxide mixture (honey formula 3–40)	Soap—washing soda
Late February	Cuprous oxide mixture (molasses formula 3–40)	..	..
Late March ..	Soap—washing soda —white oil	Soap—washing soda —white oil + cuprous oxide mixture (honey formula 3–40)	Soap—washing soda —white oil

The dates of application of the scalicides and the scalicide fungicide combination sprays were determined by the condition of the pink wax scale infestation. The final application of these sprays should have

been made in early March but was unduly delayed (approximately four weeks) because of inclement weather.

The scalicide sprays were made up according to formulae recommended by Summerville (1934), and in the combination sprays full strengths of both scalicides and fungicides were used.

Lime sulphur sprays were also applied according to the farmer's practice—(*a*) 1-10 strength just prior to blossoming, and (*b*) 1-40 in early January for the control of maori mite.

The fruit at picking time was classified and counted, the figures being shown in Table IX.

TABLE IX.

BROWN SPOT EXPERIMENT. 1938-39—PERCENTAGES OF DISEASED FRUIT PER PLOT.

Schedule.	Blocks.								Average.
	1.	2.	3.	4.	5.	6.	7.	8.	
A ..	6·0	6·9	7·3	11·0	6·3	7·9	2·4	3·4	6·4
B	14·5	7·3	9·0	8·7	8·0	6·0	6·9	1·6	6·4
C ..	20·8	32·6	21·4	16·5	21·2	27·7	8·6	7·2	19·5

Necessary difference for significance = 4·5.

A fortnight after the application of the scalicide and scalicide fungicide combination sprays, counts of live and dead scales were made to ascertain whether any loss of efficiency of the scalicides occurred when the fungicide was added.

In the case of the first scalicide application in November pink wax was the scale concerned. Samples of infested twigs were taken at random and live and dead scales counted, neglecting those scales which from the appearance of the leaf surface had not received a covering of spray. A 90 per cent. kill was obtained on the average for both the scalicide alone and in combination with the cuprous oxide mixture. No significant differences between the two treatments were revealed by statistical analysis.

A similar procedure was followed for the second application of scalicide and combination sprays. In this case samples of fruit were taken and the kill of red scale estimated in a manner similar to that used for pink wax. Again analysis revealed no significant differences between the two treatments.

From these figures it is obvious that no reduction in scalicidal or fungicidal properties occurred when the two sprays were mixed for the second and third fungicidal applications. Incidentally the three-spray schedule for brown spot control was once more proved of value.

Although actual trials have not been carried out, it is considered unlikely that loss of efficiency would occur where resin-caustic soda-fish oil or white oil sprays are used as the scalicides in the combination sprays.

In respect of these combination sprays cuprous oxide mixture shows to advantage when compared with Bordeaux mixture. The presence of lime in the latter makes the use of soap as a spreader undesirable. The combination of Bordeaux mixture with scalicides made up partly with

soap is not to be recommended, as the insoluble calcium soaps form a very thick curd, making spraying difficult and dangerous if free oil should be liberated in the process. It has also been found (Porter and Sazama, 1930) that though Bordeaux mixture may be safely combined with white oil sprays, the efficiency of the latter is reduced.

LIME SULPHUR.

Applications of this spray are usually made in winter for the control of white louse (*Chionaspis citri* Comstock), and in summer for the control of maori mite. Cuprous oxide mixture should not be added to this spray, as a black precipitate of copper sulphide mixed with sulphur is formed. While no harm to the tree would result from the use of such a mixture, the strength of the lime sulphur would be considerably if not completely reduced.

The winter application of 1-12 to 1-15 strength is made after the harvest of the crop and just prior to blossoming. The spray should be confined to the trunk and main limbs of the tree, as white louse is rarely found on the twigs. Of course, it is unavoidable that some of the spray reaches the leaves, and some growers make it a practice to spray the whole tree. The first application of the cuprous oxide mixture is often made shortly afterwards, though the period between the two sprays is usually three weeks or longer. When lime sulphur is applied to trees decomposition of the calcium polysulphides takes place to form calcium carbonate and sulphur. This reaction is probably complete in three weeks under the usual orchard conditions, so that when the copper spray is applied no interaction is likely to occur. In all the experiments conducted at Howard for the control of brown spot of the Emperor mandarin this type of spray schedule was used, and no ill-effects to the tree were noted. No black deposit of copper sulphide was formed and the control of disease was quite satisfactory.

The summer application of lime sulphur of 1-35 strength or weaker for the control of maori mite is usually made in December or January, so that it follows shortly after the second application of copper spray for the control of brown spot and black spot and precedes the third application for brown spot. Where the lime sulphur application follows closely on a copper spray a black deposit of the copper sulphide is formed. Hely (1938) reports that under certain conditions of temperature and tree growth injury may follow the use of lime sulphur after Bordeaux mixture, but no case of injury has been found under Queensland conditions where cuprous oxide has been used. In the Howard and Woombye experiments this order of application formed part of the spray schedules without detriment to the trees, and the control of the diseases and pests seemed quite satisfactory, although the rate of weathering of the copper spray residue is much accelerated. It would probably be best to allow at least a fortnight to elapse between applications of these sprays.

SULPHUR.

Sulphur dust is often used by growers for the control of maori mite. This dust may precede or follow closely applications of cuprous oxide mixture quite safely, as no reaction occurs between the two.

NICOTINE SULPHATE.

Though rarely found in a citrus spray schedule, nicotine sulphate may sometimes be used for the control of outbreaks of aphis which attack the young growth. Where the application of this spray coincides with that of the cuprous oxide mixture, the two may be mixed. As, however, it is usual to add soap to liberate the nicotine, it would be preferable to use the honey formula discussed previously in connection with scalicides.

LEAD ARSENATE.

At some future date it may be found necessary to employ a lead arsenate spray for the control of certain insect pests of citrus such as the fruit-eating, long-horned grasshoppers (Tettigoniidae) and the leaf-eating weevil (*Eutinophoea bicristata* Lea.). As the application of lead arsenate may have to be made at approximately the same time as an application of cuprous oxide mixture, the two could be mixed, but special care should be taken to see that there is no excess caustic soda in the copper spray, as this would result in arsenic going into solution, thus causing severe burning. This combination has been used on citrus without any ill-effects. The weathering of the copper residue is also not affected in any way. (Table X.)

ZINC SULPHATE-HYDRATED LIME.

A zinc sulphate-hydrated lime mixture at a strength of 4-2-40 applied in the spring is used as a check for foliocellosis or mottle leaf. This spray may be combined with cuprous oxide mixture quite safely.

Where fumigation is used for the control of insect pests, this combination should be used with caution. As will be discussed later, the rate of weathering of a copper spray has an important bearing on fumigation procedure. Accordingly, two experiments were set out to investigate the effect of zinc sulphate on the weathering of the cuprous oxide mixture. The first experiment was set out at Woombye, the spray mixtures investigated being those shown in Table X.

Samples were taken immediately the spray had dried and again when 6½ inches of rain had fallen. The analyses showing the copper residue on the leaves are given in Table X. The figure represents the average of samples taken from seven trees in each treatment.

TABLE X.

WEATHERING OF COMBINATION SPRAYS (WOOMBYE), 1939–40.

Mixture.	Original deposit per 200 sq. cms.	Residue per 200 sq. cms. after 6½ in. of rain.
	Mgms of Cu.	Mgms of Cu.
Cuprous oxide mixture	1·12	0·54
Cuprous oxide mixture + lead arsenate ..	1·14	0·53
Cuprous oxide mixture + zinc sulphate—lime ..	1·21	0·62
Cuprous oxide mixture + zinc sulpnate — lime + lead arsenate	1·14	0·64

A similar experiment was set out in the Gayndah district using the spray mixtures shown in Table XI. As in the previous experiment,

samples were taken immediately the spray had dried and again after 535 points of rain had fallen. These analyses, the average of samples from eight trees in each treatment, are shown in Table XI.

TABLE XI.

WEATHERING OF COMBINATION SPRAYS (GAYNDAH), 1939–40.

Mixture.	Original deposit per 200 sq. cms.	Residue per 200 sq. cms. after 5·35 in. of rain.
	Mgms of Cu.	Mgms of Cu.
Cuprous oxide mixture	1·29	0·82
Cuprous oxide mixture + zinc sulphate—lime ..	1·29	0·77
Cuprous oxide mixture + zinc sulphate—caustic soda	1·39	0·78

Although the above analyses show that the zinc sulphate-lime mixture has little effect on the rate of weathering of the copper, the presence of the lime, by making the spray alkaline, may introduce complications with subsequent fumigation as discussed by Butler and Jenkins (1930). The use of caustic soda as a substitute for the hydrated lime in the zinc spray is being investigated and so far seems to be successful. The rate of weathering of the copper spray is not changed in any way by this substitution, and as a mixture can be obtained very close to neutrality by the use of 4½ oz. of caustic soda per 1 lb. of zinc sulphate, the possible adverse effects of hydrated lime are eliminated. Lead arsenate may also be added to this combination quite safely, providing care is taken to avoid excess caustic soda in the mixture. The weathering of copper is also little affected by this combination.

FUMIGATION.

In districts where fumigation with hydrocyanic acid gas has been the practice for pest control, the use of copper fungicides has been little employed. When Bordeaux mixture has been applied to trees there is a possibility of severe injury following subsequent fumigation. Summerville (1934) advises that at least six months should elapse before fumigating after an application of copper spray, and even after that length of time there is still a risk of serious injury. As, in most cases, fumigation, to be at the effective time, must be used four months and sometimes two months after an application of a fungicide, it can be understood why Bordeaux mixture has not been used.

At various times during the experimental work reported here, an orchardist has fumigated trees, which a short time previously had been sprayed with cuprous oxide mixture, without any appearance of injury. This prompted an investigation of fumigation following copper sprays. In all, three experiments were carried out in the Gayndah district using large, very vigorous Washington Navel trees.

Experiment 1 (1937-38).

Forty trees were included in the experiment. These were divided into groups of four, each tree receiving one of the following treatments:—

A. One application of cuprous oxide mixture (3-40) at half to three-quarters petal fall (21st and 22nd September) and a second two months later (19th November).

B. One application of cuprous oxide mixture (3-40) in late September.

C. One application of Bordeaux mixture (3-2-40) in late September.

D. Controls—no spray.

Two blocks of four trees were then fumigated as follows:—

(1) Late November (25th November)—full dosage.

(2) Mid-December (18th December)—(*a*) full dosage.
(*b*) half dosage.

(3) Early February (4th February)—(*a*) full dosage.
(*b*) half dosage.

At the time of each fumigation, the temperatures as registered by a wet and dry bulb thermometer hung on a shady tree near the site of the fumigation were recorded. It was subsequently found that these readings were two or three degrees higher than the registrations in the standard screen. The relative humidity was obtained from these two temperatures, the figures for each fumigation being shown in Table XII.

TABLE XII.

TEMPERATURES AND RELATIVE HUMIDITIES, 1937–38—FUMIGATION EXPERIMENT.

——	1st Fumigation.		2nd Fumigation.	3rd Fumigation.
	Block 1.	Block 2		
Dry bulb	79° F.	73° F.	93° F.	90 F.
Relative humidity ..	47%	54%	35%	60%
Notes	Overcast with tendency to rain		Hot and clear	Hot and clear

A short period after fumigation, varying from ten days to a month, the trees were examined for any injury, the nature of which was as summarised below.

First Fumigation.

The percentage leaf fall in the two blocks was as follows:—

A. Two applications of cuprous oxide mixture—block 1, 70; block 2, 5-10.

B. One application of cuprous oxide mixture—block 1, 3-5; block 2, 5.

C. One application of Bordeaux mixture—block 1, 60-70; block 2, 5.

D. No spray—block 1, 1-2; block 2, nil.

Practically all the leaf fall on the trees in block 2 was on the south side where the sheets were wet by a shower of rain.

Second Fumigation.

No injury to any of the trees was noted. There was no leaf fall and even the young watershoot growth had not been burned in any way.

Third Fumigation.

A very small amount of injury of the order of 1·2 per cent. resulted from this fumigation. In all cases it could not be considered of commercial significance. Little difference could be detected between injury due to full dosage and that due to half dosage of the fumigant. The order of the degree of leaf fall with respect to the four fungicidal treatments was as follows:—

Block 1.

Full dosage—C > A > B > D.
Half dosage—C > A = B = D.

Block 2.

Full dosage—C = A = B > D.
Half dosage—C > A = B > D.

Experiments 2 and 3. (1938-40.)

In the 1938-39 season an attempt was made, using the same trees as in the experiment just described, to investigate the possibility of fumigation injury in the two months immediately following the spray application. Full dosage fumigations were made at intervals of 3 and 5 weeks after spraying but no injury resulted. As these fumigations were carried out in a very dry period (95 deg. F. and 30 per cent. relative humidity approximately at the time of fumigation) three more fumigations were tried later at intervals of 12, 13 and 20 weeks after the application of spray. A considerable amount of wet weather had intervened in the meantime, but again no injury to the trees sprayed with either Bordeaux or cuprous oxide mixtures resulted, though relative humidities of 60 per cent. to 80 per cent. with a temperature of 84 deg. F. were experienced.

In 1939-40 a third experiment was carried out by spacing the spray applications at intervals of 7, 8, 12, and 14 weeks prior to the fumigation. In no case was there any serious injury on either the Bordeaux sprayed trees or those receiving cuprous oxide. The average temperature and relative humidity at this fumigation were 90 deg. F. and 56 per cent. respectively. A week later another block similarly sprayed was fumigated at temperatures ranging from 96 deg. F. (45 per cent relative humidity) to 105 deg. F. (37 per cent. relative humidity) without any sign of injury.

Discussion.

From the variable results obtained from these experiments it is evident that copper spray-fumigation injury is bound up with such a very complicated set of environmental conditions that it is difficult to evaluate the importance of each individual factor. In only one case in the experiments just described did fumigation cause serious injury, viz., the first fumigation in the 1937-38 experiment. Apart from the fact that the temperature and relative humidity conditions vary slightly from some of those in fumigations carried out subsequently, the main difference between this and other fumigations is a shower of rain which fell shortly after the removal of the sheets. While this was not sufficient to be registered in the gauge it was enough to wet the leaves of the trees in the first block fumigated and also the sheets which were then covering the trees in the second block. With

a slight breeze the sheets were wet on one side only and it was on this side that most injury was found in the second block of trees. This is in accordance with results obtained by Quayle (1928) who found that even unsprayed citrus trees fumigated with calcium cyanide were severely injured if wet with a shower of rain shortly after fumigation. Butler and Jenkins (1930) have also shown that the foliage of trees sprayed with Bordeaux mixture and then fumigated was severely injured if wetted shortly afterwards.

Two of the trees in the first block suffered very severe injury, being almost completely defoliated. One had received an application of Bordeaux mixture two months previously while the other had been sprayed with cuprous oxide mixture only one week before being fumigated. The trees sprayed with cuprous oxide mixture two months prior to fumigation showed very little more injury than the unsprayed trees. These results suggest that trees sprayed with cuprous oxide mixture may be fumigated with safety sooner than trees sprayed with Bordeaux mixture.

Although the fumigations were carried out over a wide range of temperatures and relative humidities, these were mostly within the safety limits suggested by the manufacturers, so that the effect of these two factors on the degree of injury was not closely investigated.

That severe injury was caused by fumigation shortly after an application of cuprous oxide mixture and none when the spray had been applied two months previously suggested that weathering of the spray residue from the leaves might be the factor causing the reduction in susceptibility to injury. Accordingly in the 1938-39 season, leaf samples were taken at intervals from the trees in the experiment and the spray residue estimated by analysis. Another series of analyses was also made from samples taken from the melanose control experiment in 1938-39. Plate 3 is a graph showing the rate of weathering of the various sprays in the Woombye experiment. The figures from the Gayndah experiment were more variable owing to the dense foliage of the trees making a spray cover difficult to obtain. However, trends similar to those shown in the Woombye graph were noted here.

From this graph it appears that rainfall is the important factor in the weathering of the spray residue, and secondly, that the rate of weathering of Bordeaux mixture is much slower than that of the cuprous oxide mixture. If a limiting figure is postulated for the copper content of the spray residue, above which injury is likely to occur following fumigation, trees sprayed with cuprous oxide mixture would need far less rain to render them safe for fumigation than trees sprayed with Bordeaux mixture of the same copper content. From the experimental results, fumigation when 9 inches of rain had fallen after spraying was safe, though 1 inch was not sufficient. From the very steep part of the graph showing speedy weathering shortly after spray application, it seems possible that 4 to 6 inches of rain would be the minimum requirement. Further confirmation of this hypothesis is needed.

The above discussion does not take into account the chemical composition of the spray. Guba (1926) has suggested that the injury which follows fumigation of plants sprayed with copper fungicides is due to the divalent form of copper combining with the hydrocyanic acid gas. The compounds formed by monovalent (cuprous) copper had

no harmful effects. If this is the case injury should not be expected to occur when fumigation is applied to trees recently sprayed with cuprous oxide mixture. That such injury did occur may possibly have been due to the presence of soluble copper compounds in the spray mixture, Guba and Holland (1933) having correlated the degree of injury following fumigation with the amount of soluble copper in the spray residue.

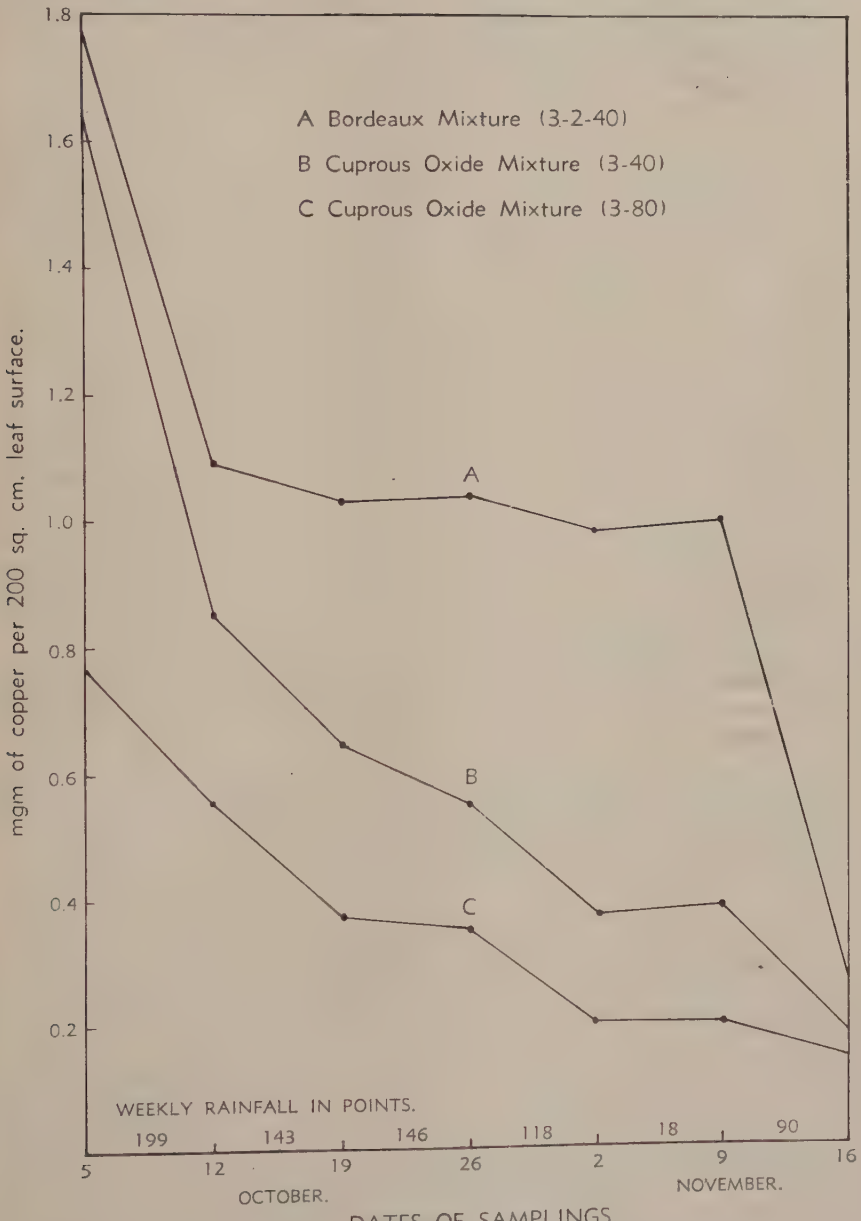


Plate 3.

RATE OF WEATHERING OF SPRAY RESIDUES, WOOMBYE, 1938-39.

From this discussion it seems probable that the reduction of the soluble copper in the spray mixture together with a reduction in the concentration of the spray used may have a profound effect on fumigation procedure after the application of copper sprays. For this reason the rate of weathering of the 3-80 strength cuprous oxide mixture shown in Plate 3 is of interest. On this evidence it is possible that fumigation may proceed with safety when as little as 2 inches of rain have fallen following the application of this spray. The quick drop in the copper content of the spray residue, due probably to the removal of the excess material applied, is sufficient to bring it below the margin above which injury would occur on fumigation.

The addition of Agral 2 as a spreader would not seem to affect this procedure in any way as the rate of weathering has been found to be unaffected. It is interesting to note here that the steep drop in the graphs for all the sprays, especially Bordeaux mixture, during the week November 9-November 16, occurred during the rainy period following an application of lime sulphur made on November 8.

SPRAY SCHEDULES FOR SOUTHERN QUEENSLAND.

From the foregoing discussion of interactions and combinations of treatments, spray schedules for the control of the diseases and pests in a citrus orchard may be formulated. As a guide for growers, basic schedules for the two types of citrus districts in Southern Queensland are given below. It is to be understood that these schedules are not necessarily the treatments an orchardist would use, but that they represent the skeleton on which, by reference to the various departmental publications concerning the pests and diseases found in his orchard, he may build his spray programme. No mention is made of the lime sulphur sprays for the summer control of maori mite. These can best be fitted in as required with due regard to the precautions discussed earlier under the heading of lime sulphur sprays. Their inclusion here would somewhat unnecessarily complicate the outlined programme.

On the coast the most important entomological troubles with which an orchardist must contend are an infestation of one or several species of scale insects. A spray programme for these districts is shown in Table XIII.

TABLE XIII.

BASIC PEST AND DISEASE CONTROL PROGRAMME FOR COASTAL DISTRICTS.

Spray.	Time of Application.	Pests and Diseases.
Lime sulphur 1–12 to 1–15 ..	Pre-blossom	Maori mite, white louse
Cuprous oxide mixture 3–40 + zinc sulphate—lime ..	½ to ¾ petal fall	Brown spot, black spot, melanose and scab together with foliocellosis
Cuprous oxide mixture (honey formula) 3–40 + scalicide	Late November to early December	Brown spot, black spot, and scale insects
Cuprous oxide mixture (honey formula) 3–40 + scalicide	Late February to early March	Brown spot and scale insects

The above spray programme is suitable for Emperor of Canton mandarins. For other early varieties such as Joppa oranges, the cuprous oxide mixture is omitted from the last combination spray. For the later varieties such as Late Valencias, the last combination spray is replaced by an application of scalicide in late March to April.

In the inland districts, as well as scale insects, the orchardist must contend with the larger horned citrus bug. At least one and sometimes two or more fumigations are recommended for the control of this insect, the number depending on the infestation and migration.

A programme incorporating two fumigations for this pest is shown in Table XIV.

TABLE XIV.

Basic Pest and Disease Control Programme for Inland Districts.

Treatment.	Time of Application.	Pests and Diseases.
Lime sulphur 1–12 to 1–15 ..	Pre-blossom	Maori mite, white louse
Cuprous oxide mixture 3–40 or 3–80 + zinc sulphate —caustic soda	½ to ¾ petal fall	Scab, melanose, and black spot, together with foliocellosis
Fumigation	November	Larger horned citrus bug
Cuprous oxide mixture 3–40 or 3–80	1 week after fumigation..	Black spot
Fumigation	Late January	Larger horned citrus bug and scale insects

By adhering to the above programme, in average seasons, sufficient rain will have fallen following spraying to render fumigation safe. It is important to note that the November fumigation precedes the second application of copper spray, the reverse order involving serious risk of injury.

The above schedule may be applied to lemons. For early varieties of citrus other than lemons, such as Washington Navels and grapefruit, the first fumigation is omitted. For late varieties, such as Late Valencia oranges and Glen Retreat mandarins, the first fumigation is also omitted, and if there is no infestation of the larger horned citrus bug, the second may be delayed until March, thereby rendering fumigation of these varieties safer.

SUMMARY.

1. A study has been made of the value of a cuprous oxide mixture, prepared from copper sulphate, molasses, and caustic soda, in citrus spray schedules in Southern Queensland.

2. The chemical composition of the spray is discussed and suggestions made for an alternative formula, using honey as a source of reducing sugars.

3. By means of field experiments, the phytocidal and fungicidal effects of the mixture have been tested in comparison with Bordeaux mixture of the same copper content.

Cuprous oxide mixture did not seem to injure the trees in the manner commonly associated with the use of Bordeaux mixture.

No differences could be found between the fungicidal efficiencies of the two mixtures for the control of brown spot, black spot, and melanose. Observations showed that scab may be controlled as well.

4. The compatibility of cuprous oxide mixture with various other citrus sprays is discussed. By modifying the original formula, the mixture may be added to sprays containing soaps and/or white oil. The efficiency of both components of these mixtures is not impaired in any way.

5. Trees sprayed with cuprous oxide mixture may be fumigated sooner after spraying than when Bordeaux mixture is used. It is suggested that this may be due to the fact that cuprous oxide mixture is removed from the leaves by rain more readily than Bordeaux mixture.

6. On the basis of these experiments comprehensive spray schedules are formulated for the control of citrus diseases and pests in Southern Queensland.

ACKNOWLEDGMENTS.

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The Buffalo Fly (*Lyperosia exigua* de Meijere).

F. H. S. ROBERTS, D.Sc., Animal Health Station, Yeerongpilly.

THE buffalo fly affords an excellent example of an insect which, whilst comparatively unimportant in its native country, has, upon introduction into a new land, become a pest of serious dimensions. In the East Indies it is not generally regarded as a harmful parasite of stock, but in Australia it has become a stock pest of outstanding importance.

The fly receives its common name "buffalo fly" from its association with the buffalo. Closely allied species occur in America (*Lyperosia irritans*) and in South Africa (*Lyperosia minuta*), where they are known as horn flies from their habit of resting on the horns of cattle.

Distribution in Australia.

The buffalo fly occurs in India, Northern China, East Indies, and New Guinea, as well as in Australia. Its introduction into Australia is thought to have occurred about 1825, when a number of buffaloes were brought into the Northern Territory by way of Melville Island. For many years the fly remained confined to the country in and around Darwin, and it was not till 1912 that attention was drawn to it as a major pest of cattle. During the next fifteen years the fly spread rapidly as a result of extensive cattle movements, and by 1927 its area of distribution extended from Broome, in Western Australia, almost to the Queensland border on the east and to the watershed of the coastal rivers on the south. It crossed into Queensland over the far north-western border in 1928. During subsequent years the distribution of the fly in Queensland fluctuated a good deal, depending upon the rainfall, but it never extended further east than Inverleigh, which is between Burketown and Normanton. It would seem that the fly's progress towards the east had been held up in this area by a stretch of comparatively dry plains country, which was apparently unfavourable to the fly. In 1939, however, the fly managed to cross this area, and almost reached Normanton. This year experienced an excellent season, as did also 1940 and 1941, and at the present time the fly's distribution within the State extends along the coast of the Gulf of Carpentaria from the Northern Territory border to the Mitchell River, thence inland for distances of 100 to 300 miles.

Description.

The buffalo fly (Plate 4, fig. 1) is a small, dark grey, biting fly, about one-sixth of an inch in length—that is, about half the size of the ordinary house fly. If examined under a lens, two well-defined dark stripes will be seen on its back or thorax, and a single central dark stripe on the brownish abdomen. The legs are usually yellowish. Projecting from the underside of the head is an erect, tubular structure called the proboscis (Plate 4, fig. 2). This contains the various structures composing the mouth parts of the fly, by means of which the fly is able to pierce the skin and suck up blood. In non-biting flies, such as the house fly, the proboscis is soft and can be withdrawn into the head, and the mouthparts are constructed for sucking only.

Habits.

Both male and female buffalo fly live on blood. Primarily a parasite of the buffalo, the fly will also attack cattle, horses, mules, donkeys,

and man. Reports indicate that sheep, when in contact with cattle, may be attacked as well.

In Australia, the fly is found chiefly on cattle. It shows a distinct preference for bulls, then stags, aged cows, bullocks, and cows. Animals in poor condition are usually heavily attacked, whilst only very few flies are to be found on calves. Man is attacked usually only when he is working infested cattle.

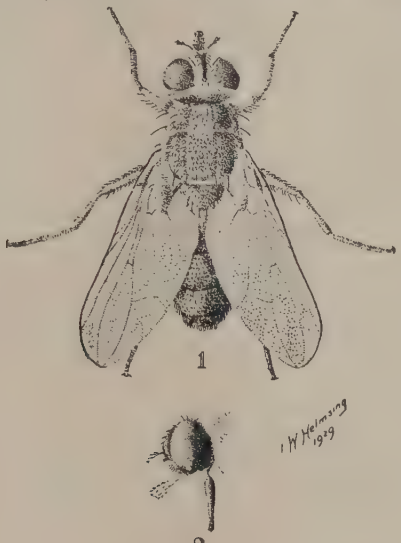


Plate 4.

The Buffalo Fly.—(1) Adult fly x 8. (2) Lateral view of head of fly showing erect proboscis.

Unlike other blood-sucking flies, such as mosquitoes, march flies, and sandflies, which visit cattle only when food is required, buffalo flies remain on the animals throughout the whole of their adult life, leaving the animals only when disturbed or for the purpose of laying eggs. Under normal conditions, the flies occur chiefly on the withers, neck, dewlap, sides of chest, shoulders, eyes, loins, and shank (Plates 5 and 6). At night the pests scatter over the body, but chiefly along the back. On cold mornings they are to be found for the most part on the shoulder, belly, and neck, rarely on the wither, and in hairy animals they burrow well into the hair. Occasionally, and chiefly in bulls, the flies may be seen resting in numbers on the bases of the horns. In the case of the eyes, these are infested more particularly if they have been previously attacked by bush flies.

The wings are normally held at an angle to the body, though under cool conditions when the flies become very sluggish, there is a tendency to close the wings, scissor fashion, over the abdomen.

When feeding, the flies work down among the hairs, and close to the skin. The body lies parallel to the hairs, and the wings are held horizontal to the body. The number of times per day that flies feed is unknown. When disturbed the flight of the buffalo fly is very characteristic. They leave the animal in swarms, which have a short, quick vertical flight, to return and settle almost immediately. They do not appear to hover or dart about, and do not crawl about over the body.

Plate 5.

HEAVY INFESTATION OF BUFFALO FLIES ON AND BEHIND THE WITHER OF A BULL.

Plate 6.

HEAVY INFESTATION OF BUFFALO FLIES ON SHOULDER, WITHER, AND BACK OF A COW.—The large sores on and behind the shoulder, and on the neck, are typical buffalo fly markings. This photo. also shows how iridescent the wings of the fly are when in the sun.

Buffalo flies dislike dust, and infested cattle being worked under dusty conditions quickly lose their infestations. When being driven, it frequently happens that the animals in the lead are very much more heavily infested than those in the tail, a phenomenon considered to be also associated with dust.

Rain, even heavy rain, apparently has little effect on the flies, for under such conditions they move to the more sheltered parts of the body.

The Life History.

The life cycle of the buffalo fly consists of four separate stages—namely, the egg, larva, puparium, and adult.

The Egg.

The egg measures about one-twenty-fifth of an inch in length, and is somewhat sausage-shaped and creamy in colour. It is deposited by the female fly in the freshly-dropped dung of cattle and buffaloes. Under natural conditions, only bovine dung is suitable for the complete development of the larva. As soon as the fresh dung is dropped, the females fly down and deposit their eggs in sheltered crevices. Under normal summer conditions the eggs hatch in eighteen to twenty-four hours. If the eggs are laid in places that dry out quickly or are exposed to sunlight they will fail to hatch.

The Larva.

The larva is a typical fly maggot, being creamy white in colour and tapering towards the head end. A fully-grown buffalo fly larva measures about half an inch. On hatching from the egg, the larva immediately burrows into the dung and keeps on burrowing as the surface layers dry out. The amount of moisture present in the dung is a very important factor in the development of the larva. The optimum moisture content is about 68 per cent. When the amount of water is much below or in excess of this figure, development is seriously affected and may cease. Under normal summer conditions, the larva completes its growth in three to five days.

The Puparium.

When fully grown, the larva makes its way into the bottom layers of the dung or into the soil. Then it shrinks to about half its size, and its skin hardens and turns brown. Inside this barrel-shaped puparium, as it is called, the adult fly gradually takes form. Inside three to five days the development of the adult is complete and, pushing off one end of the puparium, the fly makes its way into the sunlight, dries its body and wings, and flies off on its search for a host.

Duration of Life Cycle.

Thus, under normal summer conditions, the life cycle occupies seven to eleven days. Should cool conditions prevail, however, each stage in

the life cycle takes longer to complete its development, and so, during winter, the life cycle may take as long as forty-six days or more.

Length of Life of Adult Fly.

Very little is known as to how long flies will live on cattle. One observer gives this period as at least ten days, while another considers they live about twenty days. Their longevity depends upon a number of factors, chief of which appear to be humidity, temperature, and wind. Strong winds, low temperatures, and low humidities are very unfavourable to the adult fly, and when such conditions prevail, the number of flies on cattle are rapidly reduced.

Buffalo flies appear incapable of surviving any length of time away from their hosts. Even under warm, humid conditions very few flies will live for twenty-four hours, whilst under dry conditions their survival does not extend beyond a few hours. With moderately low temperatures, on the other hand, the flies become inactive and may live up to five days. Newly-emerged flies under normal conditions usually die within an hour or so unless they find a host, but, again, low temperatures may extend their survival up to six days.

The range of flight of buffalo flies is unknown beyond the information that it is at least 2 miles. The fact that flies are unable to survive for any length of time away from their hosts, however, would indicate that flight is not of any great importance as a factor in the spread of the pest. This, it is considered, is controlled almost entirely by the movements of infested cattle and probably horses.

How to Distinguish Buffalo Flies from other Flies Occurring on Cattle.

Cattle attract many different kinds of flies. Most of these feed on the sweat, scurf, and secretions of the eyes, nose, and mouth. Others bite and suck blood, such as mosquitoes, sandflies, march flies, the stable fly, and buffalo fly. Many of these flies are much larger than the buffalo fly, e.g., stable flies, march flies, and bush flies; others are much smaller and more delicate, e.g., mosquitoes and sandflies. Indeed, if one relies on size alone, there is only one fly with which the buffalo fly could be confused. This fly is known as *Hydrotaea australis*. It is a small dark-grey, almost black fly, about the same size as the buffalo fly, but of a more robust build. It is exceedingly common, and it is usually seen very busily running over the body of an animal. The buffalo fly, it will be remembered, never crawls or runs over the body when it desires to change its position—it always flies. The wings of *H. australis* are not so iridescent as those of the buffalo fly when seen in sunlight, and are, furthermore, held at a much more acute angle to the body. Finally, a careful examination will show that *H. australis* has a soft, retractile, sucking proboscis, whilst that of the buffalo fly is erect, and stands out from the underside of the head.

In examining cattle for buffalo flies, it is well to remember that the flies can more easily be detected if they are in bright sunlight, when the wings are very iridescent (Plate 6). If a wind is blowing, the flies will be found on the sheltered side of the animal.

Plate 7.

BUFFALO FLY SORES (MARKINGS) AROUND THE EYES AND ON THE SHOULDER.

Plate 8.
Extensive Sores around Shoulder and Neck caused by Buffalo Flies.

Seasonal Distribution.

During the winter months, when normal low temperatures and dry weather prevail, buffalo flies become very scarce. In some localities they apparently die out completely. In other localities, however, where there is shelter from the cold winter winds and a sufficiently high humidity, flies are able to persist throughout the winter in small numbers. Favourable localities for such persistence include, for example, the jungle swamps of the coastal fringe, sheltered permanent waterholes and cattle camps, where large numbers of cattle congregate. The cold winter winds are apparently one of the most important factors in reducing the numbers of the fly. Not only do they lower the temperatures, but they also assist in drying up the dung, and so render it unsuitable for the development of the egg and larva.

During the 1939 and 1940 winters in the Gulf country, flies persisted in relatively large numbers. This is considered to have been due firstly to the excellent summer rains which were responsible for extremely large numbers of flies; and, secondly, to unusually mild and practically windless winters.

Commencing with the spring storms, conditions gradually become more and more favourable to the flies and their numbers increase rapidly. This increase continues to about April and May, reaching its maximum just after the summer rains. Thereafter, as the weather becomes progressively cooler and drier, the number of flies dwindles.

Economic Importance.

The most conspicuous ill effects of infestation among cattle are those which are associated with worry and irritation. Cattle subjected to the irritation of countless bites of feeding flies are unable to feed and rest to the normal extent. Consequently, the animals fail to put on condition as much as they should and, in cases of severe infestations, may even lose condition.

The extent to which an animal suffers naturally depends on the number of flies attacking it. Observations have indicated that cattle can tolerate fairly well populations of 1,000 flies or less, whilst numbers in excess of 1,000 will cause ill effects, and numbers of 2,000 to 5,000 are definitely serious.

It has also been observed that animals exposed to attack for the first time suffer much more severely than animals which are accustomed to the pest. To relieve the irritation caused by the innumerable bites, cattle rub the affected areas vigorously against tree trunks and other objects. This results in the formation of large raw areas (Plates 6, 7, and 8). Although these are only superficial, they are extremely attractive to buffalo flies and other flies, particularly the ubiquitous and very common bush fly (*Musca vetustissima*), which by their constant attendance induce further worry and irritation, and also prevent healing.

Judging from the irritation caused by buffalo flies and from the effect on the milk yield by other biting flies, such as the horn fly (*Lyperosia irritans*) in the United States, and sandflies, mosquitoes, march flies, and stable flies, both in our own country and elsewhere, one must expect that should the buffalo fly ever reach our dairying districts, the effect on milk production would be serious indeed.

Acknowledgment.

The photographs shown in this article were taken by Mr. C. R. Mulhearn, B.V.Sc., Director, Animal Health Station, Oonoonba.

Poultry Farming in Queensland.

ORIGIN OF THE DOMESTIC FOWL.

SOME controversy exists as to the origin of the domestic fowl. Darwin advanced the theory that all of our breeds of to-day were offspring of a common ancestor. A species of fowl, *Gallus bankiva,* which is an inhabitant of Assam, Burma, Siam, and several other countries, was selected by him as the common ancestor.

Records indicate that the fowl was common in China 1400 B.C., but it was not introduced into Australia until 1788. Governor Phillip was responsible for the first introduction of poultry in Australia. These landed in January of 1788, and on the 1st May of the same year the poultry population consisted of 18 turkeys, 29 geese, 35 ducks, 142 fowls, and 87 chickens, whereas in 1938 the poultry population consisted of 420,577 turkeys, 97,118 geese, 632,414 ducks, and 15,359,390 fowls.

The first poultry show was held in Great Britain in 1845, but it was not until 1865 that definite standards were drawn up by the Poultry Club of England to which poultry should be bred. The breeding to well-defined standards has undoubtedly done much to improve methods of breeding, but unfortunately many of those interested in poultry bred largely for external characteristics and lost sight of production qualities.

The production qualities of poultry, however, have been brought out by egg-laying competitions. Although records of production may be claimed by many States, to the State of New South Wales must go the honour of pioneering the first test in the world, extending over a period of twelve months. This test was inaugurated in 1901, the average production per bird being 130 eggs. Since then production has gradually increased, and in 1917 it reached an average of 206 eggs per bird, which can be accepted as a fair average of the output per bird to-day. Although nutrition may have played its part, there is no doubt that increased production was materially due to breeding. Laying tests, however, were responsible for some loss of type and vigour and to obtain the greatest value from the fowl, breeding for both type and production must go hand in hand.

Recent Progress.—During the last eighteen years considerable development has taken place in this industry in Queensland. This progress can best be gauged by quoting a few statistics from the Queensland Egg Board.

Queensland Egg Board Statistics.

Year.	Eggs Received in Dozen.	Overseas Export in Dozen.
1924	1,445,000	Nil
1925	1,665,000	12,000
1930	3,935,000	831,150
1935	5,489,315	2,152,800
1941	*6,613,035	2,045,430

* Approximate.

The Queensland Egg Board only operates over the south-eastern corner of the State, but similar expansion has taken place in northern

areas. This expansion has been brought about by education, co-operative marketing of the egg through the Queensland Egg Board, co-operative buying of produce through producers' organisations, and by the greater facilities that exist to-day for the replacement of flocks by the modern incubator. Here, however, exists a danger if the rigid selection and culling of the breeding flock is not persisted with.

Value of the Industry.—The true value of the poultry industry is most difficult to determine. For the year 1938, 29,523 agriculturalists indicated that they were engaged in the poultry industry, while the estimated production for the year 1940 was 12,558,608 dozen. In addition, there are many thousands who are interested in the production of their own requirements of eggs and poultry meat.

The value of poultry raising cannot only be viewed from the value of the product of the industry. Its relation to other industries has to be considered. There is no class of animal that receives more care and attention in relation to feeding than the fowl. The fodder requirements of the fowl are derived from other agricultural industries. For every 100,000 fowls in the State, 4,000 tons of fodder are required annually. Grain, mill offal, lucerne chaff, meat meals, and other by-products of primary industries form the diet of the fowl. The part it plays in a well-balanced agricultural industry can readily be gauged.

Legislation.—Although until comparative recent years this industry was small, it now enjoys legislation permitting and controlling—

1. The orderly marketing of eggs.
2. The grading of eggs.
3. The branding of eggs.
4. The cold storage of eggs.
5. The manufacture of frozen egg.
6. The control of poultry disease.
7. The slaughter of poultry for human consumption.
8. The voluntary registration of hatcheries.
9. The licensing of persons engaged in the determination of the sex of day-old chickens.
10. The branding of chickens determined as males by licensed persons.
11. The fixation of commission charges for poultry sold by agents.

Many benefits of such legislation are in evidence.

BREEDS OF POULTRY.

It is impossible to deal with all breeds, and reference will only be made to those that are used to any extent in this State for commercial purposes.

All breeds of poultry readily adapt themselves to the varying climatic conditions along the coastal areas of Queensland, but, as a general principle, it can be taken that what are referred to as heavy or dual-purpose breeds and game breeds are more adversely affected by extremes of heat than those referred to as light breeds, while the light breeds appear to be more adversely affected by extremes of cold than the dual-purpose and game classes.

Extremes of heat, cold, wind and rain are not conducive to the best results with any breed, and consequently protection should be

afforded all classes of poultry against these adverse conditions. Although dual-purpose breeds appear to be more adversely affected by heat than light breeds, it is considered that conditions of housing could be such as to permit of the successful raising of these breeds in the hottest districts of the State.

Commercial poultry may definitely be grouped in three classes, viz.:—

Light Breeds.

Light breeds are usually breeds developed extensively for egg production with little or no attention being paid to table qualities. This class of bird may also be classed as a non-sitter. Among many strains individuals will be found in which the broody trait has not been bred out, but taken collectively they may be classed as non-sitters. Another character of the light breeds is that they are layers of white-shelled eggs.

Among this class Leghorns predominate, with probably the Ancona being the next most popular, followed by the Minorca.

Heavy or Dual Purpose Breeds.

Breeds of this class have been developed for table and egg-producing qualities. Taken as a group they are not as efficient egg producers as the light breeds, but individuals of this class hold the record as egg producers in this State, namely 354 eggs in 365 days. Without exception, all heavy breeds are very docile, whereas light breeds are of a more or less nervous disposition. Breeds of this class may also be referred to as sitters. Every effort is made to breed this characteristic out, and it has been done to some considerable extent by many breeders, but in the best of flocks broody hens will be found. The egg of this class should be brown in colour, although many pale eggs will be found in all breeds.

The most popular breed of this class is the Australorp. The Langshan is probably the next in favour, followed by the Wyandotte, Rhode Island Red, and Sussex.

Game Class.

This is essentially a table class. Although it may not prove profitable to breed game fowls for table purposes, it is found commercially sound to breed birds exclusively for the table, the crossing of any dual-purpose fowl with the game will add to the table qualities of the progeny. This appears the most profitable manner in which the game fowls might be utilised.

Among the game class is the Old English, Indian, and Australian game.

LOCATION AND NAMES OF EXTERNAL PARTS OF THE FOWL.

(With an explanation of parts and faults of the commercial breeds of Queensland.)

Abdomen.—The rear portion of the body: that portion not protected by a bony structure.

Faults.—Sagging, hard, due to excessive fat or internal disorders and distended with fluid.

Back.—The top of the body from the neck to the base of the tail. It should be long, but varies according to the breed. It should also be wide and flat.

Faults.—Narrow, roach, or any deformity.

Beak.—Both mandibles. The beak should be of medium length, strong, and slightly curved.

Faults.—Long, straight, short, crossed, and parrot.

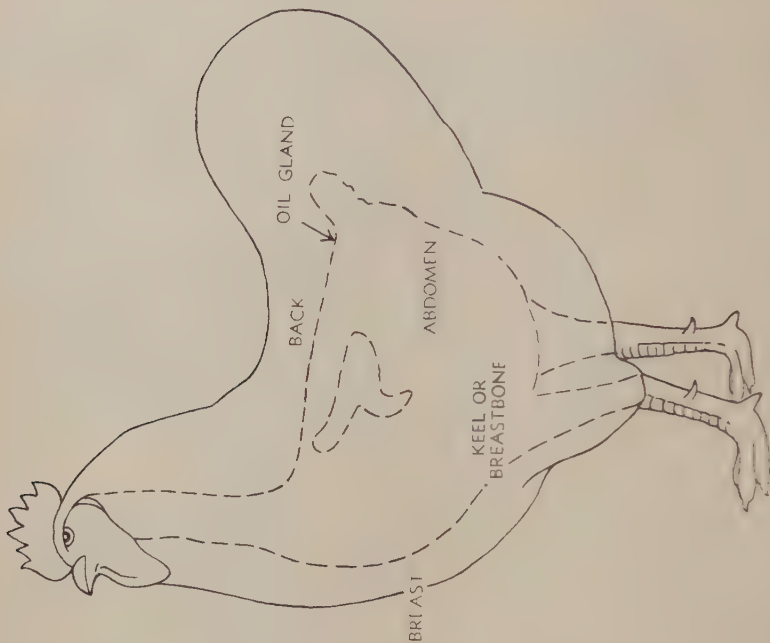


Plate 10.

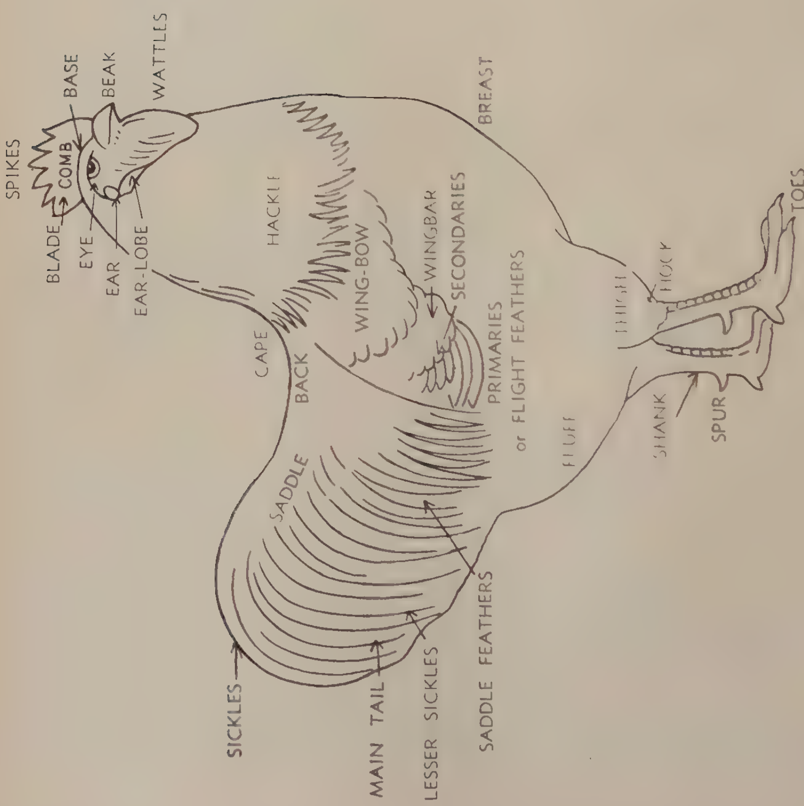


Plate 9.

BREAST.—From the point of the keel to the base of the neck.

Faults.—Cut away, frequently termed "lack of front." Pendulous due to the enlargement of the crop.

COMB.—A fleshy growth on top of the skull. Two types in poultry bred in this State for commercial purposes, viz., Single and Rose. Peacombs are found on Indian Game.

Single Comb.—Single, fleshy, serrated, formation extending from the beak backward and over the head. The serrations should be deep and even, and broad between the points of the spikes. Portions of the comb are referred to as the—

Spikes—The pointed portion on the upper part of the comb.

Blade—The portion of the comb at the rear of the last spike.

Base—The portion of the comb adjoining the head.

Rosecomb.—A low, solid, fleshy mass, covered on its upper surface with small rounded points, frequently referred to as "working," terminating in a well-defined spike at the rear, known as the leader.

Faults.—Single—Lopped in males and heavy breed females, erect in light breed females, such as Leghorns, crooked, twisted, thumb marks, coarse, unevenly serrated, and side sprigs.

Rosecomb.—Lopped, smooth, hollow or split centre, twisted or crooked.

EAR.—The organ of hearing, which is situated at the rear of and slightly below the eye. It is protected with a tuft of small feathers.

EAR-LOBES.—The raised skin below the ears. Should be correct size and shape in conformity with the standard, smooth and open.

Faults.—Wrinkled, incorrect size or shape, folded, red in white lobes, white in red lobes, blistered.

EYE.—The eye should be full, round, prominent, bright, and expressive, conforming in colour to the standard of the breed.

Eye-lids.—The eye-lids consist of upper, lower, and a thin white nictitating membrane, which is mainly concealed.

Eye-ring.—The edges of the eye-lids. In a yellow-skinned bird the yellow pigment bleaches out very rapidly from the eye-ring with production.

Faults.—Pupil misshapen; iris incorrect colour. Eyes that give the appearance of being other than round; sunken eyes.

FACE.—The bare or almost featherless area between the lobes and the point of the beak. Should be free from feathers, bright red, smooth, and full.

Faults.—Excessive feathering, skin dark or white, wrinkled, or sunken.

LEG.—Includes the thigh (fleshy part) and shank (scaly part).

Faults.—Bow-legged, in-kneed, and malformations.

NOSTRILS.—The openings at the base of the upper mandible of the beak extending into the head.

OIL-GLAND.—Situated immediately in front of the base of the tail. Supplies oil for the bird's feathers.

SADDLE.—The rear portion of the back, extending to the tail from which the saddle hackle or feathers grow in a male. In a female the feathers are termed the cushion.

SPUR.—The horn-like growth on the shanks of males. A fault in females.

TOES.—There are four toes, three projecting forward and one backward. The toes should be straight, and in length proportionate to the bird.

Faults.—Crooked; enlarged joints.

WATTLES.—The pendant fleshy growths at the sides and base of the beak, conforming with the comb in size.

Faults.—Misshapen, beefy, uneven in size, and any tendency to fold inwards in front.

WINGS.—The upper limbs or arms of the fowl.

Faults.—Carried unevenly or loosely, resulting in the wing being not held in proper position, termed slipwing, associated with twisted and curled flight feathers.

PLUMAGE.

CAPE.—The short feathers underneath the neck hackle coming over the shoulders, collectively shaped like a cape.

CUSHION.—The mass of feathers at the rear of the back of a hen, partly covering the tail, and corresponding to the saddle in the male.

Fault.—In most commercial breeds, looseness of cushion is a serious defect.

FLUFF.—Soft downy feathers around the thighs and the abdomen; the downy part of feathers; the small feathers between the toes of birds.

HACKLES.—The neck plumage of a fowl, or the saddle plumage of a cock, consisting of long, narrow pointed feathers.

LEG FEATHERS.—Feathers projecting from the outer side of the shanks—e.g., Langshans.

SICKLES.—The long, curved feathers of a male's tail.

TAIL.—True tail feathers are long, broad, and stiff. Tail coverts are in front of and at the side of the tail.

Faults.—In tail carriage—squirrel, low and wry.

UNDER-COLOUR.—The colour of the fluff of the feathers.

WING.—*Primaries.*—The outer flight feathers, hidden when the wing is closed.

Secondaries.—The inner flight feathers which are on the outside when the wing is closed.

Wing-bar.—Any line of dark colour across the middle of the wing caused by the colour or marking of the feathers known as the lower wing coverts.

Wing-bay.—The triangular part of a folded wing between the wing-bar and the end of the flight feathers.

Wing-bow.—The upper or shoulder part of the wing.

Faults.—A wing so irregularly formed that it shows a decided gap between the primaries and secondaries.

STANDARDS.

In order to maintain breed characteristics it is essential to have standards to which to breed. Thousands of fowls are bred yearly by producers with little or no consideration being given to type. The departure from type may be attributed in some degree to the exaggerated specimens at times seen on the show bench, and to greater consideration being given by judges to feather markings than to types and egg-producing qualities.

From the one breed in many instances there has been developed two types, namely, the standard-bred fowl and the utility-bred fowl. In trying to perfect his bird from a show point of view the fancier sacrificed egg qualities, while the egg producer in the race to produce eggs sacrificed type. The egg producer sacrificed type to such an extent that commercial breeders years ago drew up a utility poultry standard to be read in conjunction with the standard of perfection as laid down by the Poultry Club of England.

This move has proved of great advantage to the industry, insofar as the improvement in type that has taken place has materially assisted in maintaining the health and stamina of our flocks.

LEGHORNS.

General Characteristics.

THE COCK.

Head.—Skull fine. Beak stout, the point clear of the front of the comb. Eyes prominent. Comb (*a*) single or (*b*) rose: (*a*) perfectly straight and erect, large but not overgrown, deeply and evenly serrated (the spikes broad at their base), extending well beyond the back of the head and following, without touching, the line of the head, free from "thumb marks" or side spikes; (*b*) moderately large, firm (not overgrown so as to obstruct the sight), the leader extending straight out behind and not following the line of the head, the top covered with small coral-like points of even height, and free from hollows. Face smooth. Ear-lobes well developed and rather pendent, equally matched in size and shape, smooth, open, and free from folds. Wattles long and thin.

Neck long, profusely covered with hackle feathers.

Body wedge-shaped, wide at the shoulders and narrowing slightly to root of tail; round and prominent breast; long back sloping slightly to the tail; large wings tightly carried and well tucked up; moderately full tail at an angle of 45 degrees from the line of the back.

Legs moderately long. Shanks fine and round (flat shins objectionable) and free of feathers. Toes (four) long, straight, and well spread.

Carriage very sprightly and alert. There should be no suggestion of stiltiness.

Plumage of silky texture, free from woolliness or excessive feather.

Handling, firm with abundance of muscle.

Weight not less than 6 lb.

Plate 11.
White Leghorns.

THE HEN.

With the exception of the comb (in the single-combed varieties falling gracefully over either side of the face without obstructing the eyesight) and the tail (carried closely and not at such a high angle), the general characteristics are similar to those of the cock, allowing for the natural and sexual differences. Weight not less than 5 lb.

Colour.

Beak yellow or horn. Eyes red. Comb, face, and wattles bright red. Ear-lobes pure opaque white (resembling white kid) or cream, the former preferred. Legs and feet yellow or orange.

THE BLACK.

Plumage.—Rich green-black or blue-black, the former preferred, and perfectly free of any other colour.

THE BROWN.

Plumage of the Cock.—Neck-hackle rich orange-red, striped with black, crimson-red at the front below his wattles. Back, shoulder-coverts, and wing-bow deep crimson-red or maroon. Wing-coverts steel-blue with green reflections forming a broad bar across; primaries brown; secondaries deep bay on the outer web (all that appears when the wing is closed) and black on the inner. Saddle rich orange-red with or without a few black stripes. Breast and under-parts glossy black, quite free from brown splashes. Tail black glossed with green; any white in tail is very objectionable. Tail-coverts black edged with brown.

Plumage of the Hen.—Hackle rich golden-yellow, broadly striped with black. Breast salmon-red, running into maroon around the head and wattles, and ash-grey at the thighs. Body colour rich brown, very closely and evenly pencilled with black, the feathers free from light shafts, and the wings free from any red tinge. Tail black, outer feathers pencilled with brown.

THE WHITE.

Plumage.—Pure white free from straw tinge.

Scale of Points.

THE BLACK.

Head (comb 12, lobes 15)	27
Colour	25
Type	15
Size	15
Condition	10
Legs	8
	100

THE BROWN.

Head (comb 12, lobes 16)	28
Colour	20
Type	15
Size	15
Condition	12
Hackle	10
	100

THE WHITE.

Type	25
Head (comb 10, lobes 10)	20
Colour	20
Size	15
Condition	10
Legs	10
	100

Serious Defects.—Cock's comb (single) twisted or falling over, or hen's comb erect; rose comb such as to obstruct the sight; ear-lobe red; any white in face; legs other than yellow or orange; wry or squirrel tail; any bodily deformity. In Blacks, dark legs or eyes. In Browns, white feathers.

[*Original by A. F. Lydon, in "The Feathered World."*

Plate 12.

BROWN LEGHORNS.

As far as is known, the Leghorn originally came from Italy, its name being derived from a town in that country. The characteristics of the present-day Leghorn have been largely fixed by American and English breeders as a result of most careful selection over a long period of years.

There are many varieties of Leghorns, e.g., White, Brown, Black, Buffs, Pile, Blue, Exchequer, Cuckoo, Duckwing (silver and gold), and Mottled.

The Leghorn, more particularly the White Leghorn, is possibly the most popular breed or variety of fowl in the world, and it has maintained this position for at least half a century, and has done so principally due to its prolificacy. Other characteristics of the breed are that it comes into production early in life, and being of a fairly hardy constitution is therefore easy to rear. It is a great forager and is most active and alert.

Although there are a large number of varieties of Leghorns, the White stands supreme in the commercial poultry world, followed in order by the Brown and the Black.

The table quality of the flesh of this breed is not considered equal to that of heavy breeds, although young cockerels meet a fair demand. Their small size is greatly against their economic value.

With regard to size, there are two extremes which are likely to occur when breeding either for exhibition or egg production. When breeding for the former, the general tendency is to increase the size of the breed. This does just as much harm to the Leghorn as the commercial poultry farmer, who, in striving for egg production, breeds from undersized birds. These factors should not be lost sight of when selecting for the breeding pen. Under these circumstances, it is advisable to always bear in mind the standard weights as laid down and be just as harsh with a bird that is overweight, as one that is underweight.

Varieties.

The White.—Possibly this variety will always remain supreme in the Leghorn family because of the ease with which it can be bred for egg production and also for exhibition. When selecting birds for breeding, the individual birds should be balanced up by firstly giving consideration to type, avoiding any exaggerated characteristics. When the actual egg production is known, there is a general tendency to breed from high producers, irrespective of body conformation. This situation is possibly more common among White Leghorns than among all other fowls, as a greater number are tested for egg production.

The Brown.—This variety is difficult to breed true to type and colour. Its popularity has declined of recent years. Some commercial poultry farmers continue with the Brown Leghorn and claim that they are equal as layers to the White.

To produce exhibition cockerels it is necessary to mate an exhibition male with a female that is much too dark for exhibition purposes. To breed exhibition females, matings have to be reversed, mating together an exhibition female and a male very light in colour. It is generally recognised among the poultry fanciers that the exhibition female line are indifferent layers, whilst the females of the exhibition cockerel line are quite good layers. As a commercial proposition the latter could be fostered.

Another fault which is fairly common in Leghorns, but possibly more pronounced in Brown Leghorns, is the eye colour or the colour of the iris. It should be red, but there is a tendency towards straw colour, and even greenish in colour. The latter is a very serious fault, because of the tendency towards shortsightedness or blindness, and birds that are shortsighted cannot be profitable.

The Black.—The Black Leghorn is a good layer, but difficult to breed true to colour. Some breeders resort to double matings for exhibition purposes, but good laying strains could hardly be built up upon this principle. Birds with a good green sheen, free from purple and white in undercolour, should be selected for breeding purposes. White in undercolour is a serious defect which increases with age. Cock birds, sound in undercolour, are particularly valuable. White in wings of young stock is not uncommon, but disappears with the growth of adult plumage.

[*Original by Wippell, in "The Poultry World" (England).*

Plate 13.

THE ANCONA.

ANCONAS.

General Characteristics.

THE COCK.

Head.—Skull moderately long, deep, and inclined to width. Beak of medium length and moderate curve. Eyes prominent. Comb (*a*) single or (*b*) rose: (*a*) upright, of medium size, with deep serrations and five to seven spikes (broad at their base), the outline forming a regular convex curve, the back following the line of the head, free from "thumb marks" or side spikes; (*b*) medium size, low and square front, tapering towards the leader (which should follow the curve of the neck and not be straight out or upwards), the top covered with small coral like points of even height, and free from hollows. Face smooth. Ear-lobes inclined to almond shape, of medium size, and free from folds. Wattles long and fine.

Neck.—Long, profusely covered with hackle.

Body.—Moderately long, with close and compact plumage, broad front, slightly narrow saddle; full broad breast carried upwards; large wings well tucked up; full tail carried well out.

Legs.—Moderately long. Thighs well apart and almost hidden by the body feathering. Shanks and feet free from feathers. Toes (four) rather long and thin, well spread.

Carriage.—Upright, bold, and active.

Weight.—6 lb. to 6½ lb.; cockerels, 5½ lb.

THE HEN.

With the exception of the single comb, which falls, without obscuring the vision, on one side of the face, the general characteristics are similar to those of the cock, allowing for the natural sexual differences. Weight, 5 lb. to 5½ lb.; pullet, 4½ lb.

Colour.

Beak yellow shaded with black or horn, preferably not wholly yellow. Eyes orange-red with hazel pupil. Comb, face, and wattles bright red, the face free from white. Ear-lobes white. Legs and feet yellow mottled with black.

Plumage beetle-green with white tippings (the latter free from black or grey streaks), the more evenly V-tipped throughout with white the better, but tipped and not laced or splashed. Under-colour black. All the feathers should be black to the roots, with beetle-green surface, and only the tips white.

Scale of Points.

Colour and markings: purity of white, quality and evenness of tipping, 20; beetle-green ground colour, dark to skin, 15	35
Head (comb 10, eyes 5, beak 5, lobes 5)	25
Type and carriage	15
Texture, general	10
Legs, colour	5
Condition	5
Size	5
	100

Serious Defects.—White in face; white or light under-colour; plumage other than black and white; any deformity.

This breed is believed to have originated in Ancona, in Italy.

They are extremely hardy, quick growers, great foragers, and layers of white-shelled eggs. A notable feature of the Ancona is its highly nervous temperament. It is a very handsome, interesting breed, that will more than pay its way commercially. As a table fowl the Ancona is equal to the Leghorn in quality of flesh.

As regards type, they somewhat resemble the Leghorn, though smaller, and lower set, being shorter in thigh. The back is somewhat shorter and not so straight, whilst a characteristic feature of the breed is that the fullness of breast is carried higher than in the Leghorn.

The colour is not just black and white splashes, but calls for white tipping on a black background. The standard calls for feathers to be "V" tipped. The size of the "V" is not defined. This leaves much to the discretion of the breeder. Tipping should be clearly defined without being splashed with black or grey. White flights are fairly common, and very difficult to breed out when aiming at obtaining correctly tipped birds, and due allowance can be made for such a fault.

Light undercolour is a fairly common fault, and is classified as a serious defect, and must be considered as such. Undercolour should be dark right to the skin. The ideal leg colour is yellow mottled with black. Look for definite black mottled (or spots), not patches of black shading, and yellow must predominate (yellow mottled with black).

In breeding it is better to use a male with clean yellow legs than one in which the black predominates; the latter will tend to produce a preponderance of blacklegged females.

Fig. 1.—Correct Tipping.

Fig. 2.—Incorrect Tipping.

Plate 14.

ANCONA FEATHER SHOWING CORRECT AND INCORRECT TIPPING.

MINORCAS (Non-sitters).

General Characteristics.

THE COCK.

Head.—Skull sufficiently long and broad to provide a substantial foundation for the comb. Beak stout, fairly long. Eyes full, bright, and expressive. Comb (*a*) single or (*b*) rose: (*a*) medium size, perfectly straight, upright and rigid, not extending over the point of the beak, the back following without touching the line of the neck-hackle, nicely arched, and evenly serrated with preferably five wedge-shaped spikes, free from "thumb marks" or side sprigs; (*b*) medium size, firm, low, and square front, oblong shape, tapering towards the leader (which should follow the curve of the neck and not be straight out or upwards), the top covered with small coral-like points of even height, free from hollows. Face smooth, the skin taut (wrinkles objectionable), as free as possible from feathers or hairs. Ear-lobes almond-shaped, medium size, widest part on the top, more elongated than round, of kid-like texture, flat and of firm substance, fitting closely to the head and not extending over the face, and without any tendency to hollowness, slackness, or roundness. Wattles long, of oval shape, and fine texture.

Neck.—Long, hackle extending well down to body.

Body.—Broad-shouldered, fairly long, and compact with a deep keel and straight breastbone; horizontal carriage; rather long back; full round breast; fairly long wings carried closely to the sides and with broad flight feathers; fully furnished tail with long, broad, and nicely curved sickles, and set on at an angle of 45 degrees.

Legs.—Of medium length, but without any tendency to stiltiness. Shanks strong but fine bone, free of feathers, straight and wide apart, no tendency to "knock-knees." Toes (four) long, fine, and well spread.

Carriage.—Upright, active, and alert.

Weight.—6 lb. to 8 lb.

THE HEN.

With the exception of the single comb (which is carried gracefully over one side so as not to obstruct the sight), the general characteristics are similar to those of the cock, allowing for the natural sexual differences.

Weight.—5 lb. to 7 lb.

Colour.

THE BLACK.

Beak dark horn. Eyes dark. Comb, face, and wattles blood-red, the face totally devoid of white or blue skin. Ear-lobes perfectly white. Legs and feet black or very dark slate, the latter in adult birds only.

Plumage.—Brilliant green-black.

THE WHITE.

Beak white. Eyes red. Comb, face, and wattles blood-red. Ear-lobes white. Legs and feet pink-white.

Plumage.—Lustrous silver-white.

Scale of Points.

The Single Comb.

Head (face 15, comb 15, lobes 10)	40
Colour (plumage 10; legs, eyes, and beak 8)	18
Type	17
Size	15
Condition	10
	100

Serious Defects.—White or blue in face; wry or squirrel tail; feathers on shanks or toes; other than four toes; side sprigs on comb; plumage other than black or white; legs other than black or dark slate in Blacks, or white in Whites.

Plate 15.
MINORCAS.

There is little known of the origin of this breed. It is generally accepted that the Minorca is a descendant from the Castilian fowl. Its name is derived from the Island of Minorca, off the East Coast of Spain, from where the first importations into Britain were made.

The Minorca is a good layer and has the inherent characteristic of laying large eggs. It is generally accepted that the average weight of eggs laid by this breed is heavier than eggs laid by any other breed. The eggs, having white shells, are most attractive in appearance and appeal to the average housewife.

The Minorca is possibly the largest of the Mediterranean or light breeds, and being white skinned is attractive when dressed for table

purposes. However, there are some objections to it as a table bird, namely, that it has black pin feathers.

The Minorca, although well known, has not been persevered with to any extent by commercial poultry farmers. Backyard poultry keepers who have a preference towards white shelled eggs would find the Minorca admirable for this purpose.

This breed is noted for its long back, the shoulders being broad and the body reasonably deep and having somewhat of an oblong, compact appearance as the feathering is fairly close. The male has a sloping back with a reasonably long flowing tail which sets off its body and gives it a somewhat racy and active appearance. The back of the female is nearly horizontal, and the tail carried fairly low.

The breed is also noted for their large combs, wattles, and the outstanding characteristic of large white earlobes. The comb should not be excessively large and beefy. Smallness of earlobes is another common fault, more particularly among our utility Minorcas.

Varieties.

The Black.—The black is common in Queensland. Little difficulty is experienced in breeding this variety. There are some characteristics, however, that must be guarded against. Some of the principal faults are as follows:—Light coloured eyes, such as reddish or hazel, in-knees, light undercolour, small lobes.

There is also a tendency towards white in face or blue in face, but these points are not quite so common as those previously mentioned. The standard calls for a brilliant green sheen on the plumage. The plumage, as a general rule, particularly in the female, is a dull black colour. At one time purple sheen, or barring, was fairly prevalent. This fault has practically been bred out, but should always be avoided where possible in the selection of breeding stock.

The White.—This variety is very uncommon in Queensland.

[TO BE CONTINUED.]

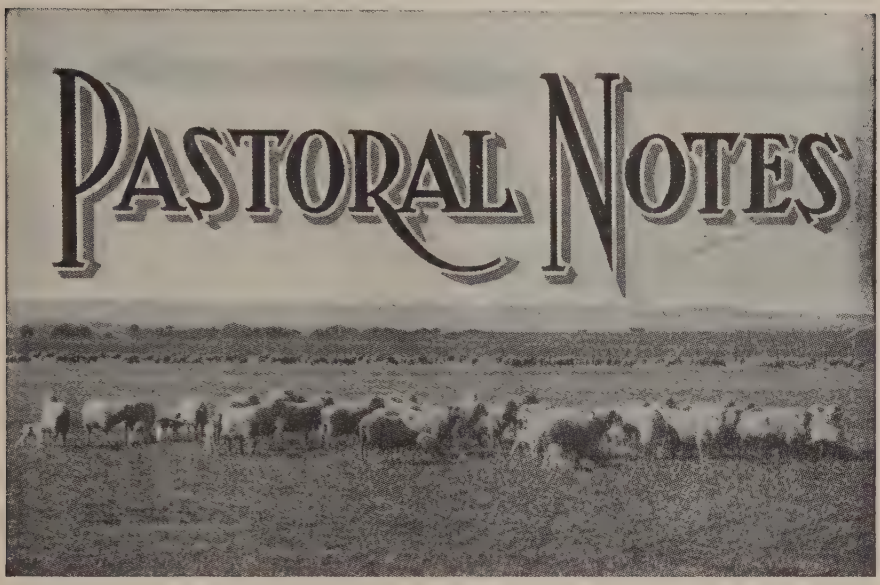
THE FEEDING OF FOWLS.

The domestic fowl appears to have no sense of smell and but little of taste. The senses of sight and touch, however, are very keenly developed, so that it becomes important to prepare poultry foods in an attractive form. The fowl relies largely on past experience in accepting food, and for that reason feeding problems must be always a subject of close study.

Excessively fine, dusty foods—e.g., some biscuit meals—should never be fed without some preliminary treatment. They tend to cause clogging in the mouth, and fine particles lodged in the respiratory tract are a source of irritation. There also is the additional danger of distended crops. Such dry foods should be incorporated carefully in a mash and, if necessary, moistened.

A food which is flaky, but not brittle, is well taken by fowls—hence the popularity of bran in mashes. Hard grains should be crushed or ground coarsely. Soaking is an alternative method of helping the gizzard to cope with hard foods.

Predigested, fermented, or malted foods are actually lower in nutritive value than the material from which they are derived and, in normal circumstances, should not be purchased.



Parasitic Worms in Calves.

DURING autumn and winter worms may prove very troublesome among calves, especially in dairying districts. The worms are picked up from the pastures during the summer, and, as the grass dries off and becomes less nutritious during the autumn and winter, the effects of the infestation become evident.

The first symptom of worm infestation in calves is a loss of condition, accompanied by occasional attacks of scours. As time goes on the animals become decidedly poor in condition and anaemic. They frequently show a paleness of the membranes of the eyes and mouth, a dropsical swelling under the skin of the jaw (bottle jaw), and are continually scouring. The coat becomes rough and staring, and eventually the animal becomes too weak to stand, and lies down and dies.

The control of worm diseases in calves may be successfully accomplished by paying attention to nutrition and feeding, prevention of infestation, and treatment.

Feeding.—It is generally recognised that an animal in a well-nourished condition is able to withstand the ravages of worms to a much greater degree than an animal whose diet is poor. As already pointed out, worms are most troublesome among calves during the period when the pastures are dry and contain little nutriment. Furthermore, the losses are greatest among the "poddies" in the dairy herd, whose feeding frequently receives insufficient attention. Much good can, therefore, be done by the supplementary feeding of calves during the autumn and winter.

Prevention of Infestation.—Calves become infested when they pick up the worm larvæ as they graze in the pastures. The worm larvæ arise from eggs which are passed out from infested animals in the dung. Moisture is essential for the development of the worm eggs and the existence of the larvæ. Therefore, in order to break the cycle and so lessen the degree of infestation, clean up the manure as often as practicable; make use of a system of paddock rotation in which calves are continually moved from one pasture to another, or are grazed alternately with horses; and avoid the use of swampy pastures, selecting for the calves only those paddocks which are well drained.

Treatment.—At present little is known of the treatment of calves for worms. Bluestone will, however, remove the large or twisted stomach worm, which is one

of the most troublesome of calf parasites. This drench is made by dissolving 1 lb. of fresh bluestone in 5 gallons of water, and the dosages are as follows:—

Calves, four months, 1½ fluid oz.; calves, six months, 2 fluid oz.; calves, nine months, 3 fluid oz.; calves, twelve months, 4 fluid oz.; calves over twelve months, 6 fluid oz.

No starvation is required. The calves should be given two drenches with an interval of fourteen days during April or early May. A further drench should be given in June and again in July.

RED-WORMS IN HORSES.

Red-worm disease is one of the most important diseases of horses in Queensland. The disease is caused by the presence of large numbers of red-worms, which inhabit the first part of the large bowel. These worms vary in size from about ½ inch to 1½ inches in length and, in a freshly-killed carcass, may be found adhering to the membrane on the inside of the bowel. Their reddish colour is due to the fact that the worms suck blood.

If the worms are numerous, the infested animal does not thrive well, the coat becomes rough, and loss of condition and weakness follow. Diarrhœa is frequently present, and in severe cases the blood becomes thin, the eyes become sunken, the whole appearance of the animal becomes very dejected, and finally death may supervene. The symptoms are gradual in their onset, and the disease may thus be in an advanced stage before it attracts the attention of the owner.

The worms do not multiply within the bowel, and each one of the many thousands that may be present has been picked up as a young worm from the pastures. These young worms in the pastures have arisen from worm eggs which have been passed from the body of the horse in the dung. As these young worms may live among the grass as long as four years, a paddock on which horses are permanently grazed may become heavily infested.

The most efficient drug for the treatment of red-worm disease is oil of chenopodium, which may be most easily administered after mixing with raw linseed oil, by means of a bottle or a drenching bit. The animal to be treated should be starved for thirty-six hours before, and for four hours after the administration of the drug. The oil of chenopodium is given at the rate of 1½ drams for every 250 lb. live weight in 1 to 2 pints of raw linseed oil. Oil of chenopodium is a highly poisonous drug and those wishing to use this treatment are advised to get in touch beforehand with the Animal Health Station, Yeerongpilly. In areas possessing a high rainfall, three or four treatments should be given during the year.

In addition to treatment, an attempt should be made to prevent reinfestation. For this purpose, it would be better not to graze horses continually in a single paddock, particularly if it is swampy. Attention should be given to the regular collection of manure from stables and yards. Heavy stocking is not to be recommended, and young horses (up to three years) should, if possible, be kept away from pastures that have been much grazed by horses.

A TICK-CAUSED CATTLE DISEASE.

Anaplasmosis is a disease of cattle which is caused by a minute blood parasite. Under natural conditions it is spread by the tick. When cattle are inoculated for tick fever, it happens frequently that they show signs of sickness about a month to six weeks after the inoculation. This was often recognised by stockowners and was called the "second reaction." It is now known that this second reaction is due to an entirely different organism from the one that causes ordinary tick fever or redwater.

The chief symptoms are dullness and a disinclination to feed. This lasts for a week to ten days, during which the animal may lose much condition. Jaundice is also seen. Sometimes the animals take a long time to recover completely.

Although the anaplasm is widely distributed throughout the tick-infested area of Queensland, outbreaks of anaplasmosis in the field are unusual. Just recently, however, attention has been drawn to two or three instances of deaths occurring in dairy cows in which inquiry and examination have shown that the mortality was due to anaplasmosis.

Treatment is of little value. It is best to leave the animal alone. Driving the animal is particularly harmful. A mild purgative is useful. Drastic drug treatment of any kind is to be avoided.

Dairy Pastures.

EFFICIENT production is the only form of economic production, and this perhaps applies more to dairying than to any other primary industry.

Efficiency is achieved by ensuring that cows receive the right food in the right quantities. The cheapest means of filling the first requirement is by herd testing and culling, since by this method only high-producing cows are maintained on the farm.

Nowadays, the value of dairy land is judged not by the number of cows it will carry but by the butter-fat production per acre. Once this idea is fixed in mind it becomes obvious that the higher the cow's yield the more economic a producing unit she becomes. Low producers mean reduced output and reduced efficiency in the working of the farm.

As the dairy cow is required to produce large quantities of milk which is rich in protein, it follows that it must be given foods which are likewise rich in protein. There is little difference between the food values of the various popular cultivated grasses, which in the early stages of growth are equal in protein content to many valued concentrates. The young shoots are very rich in this respect, and this accounts for rapid recovery of cattle grazing on pastures after rain following spells of dry weather, or after a burn.

Here, then, is a natural food for the dairy cow readily available. It is economic, too, because with a little care it can be produced in large quantities and it requires no labour in feeding. The dairy pastures, then, deserve special attention to maintain them at an efficient standard. There are several ways of maintaining and improving pastures, namely:—

(1) The growing of grasses which have a high feeding value;
(2) Top dressing pasture land;
(3) Rotational grazing, or, in other words, feeding the grass while in its young stage of growth;
(4) Renovation of pastures.

In selecting grasses, attention must be given to their adaptability to local conditions, period of growth and production, nutritive value, palatability, and suitability for grazing and haymaking. The length of the grazing season is increased and the returns improved by the use of top dressing. Its practicability depends on the increased returns in terms of cash.

Rotational grazing does not involve so great an outlay and is more a matter of pasture improvement by ensuring the economical use of herbage. The subdivision of holdings to provide rotational grazing appears to offer a ready means of immediate benefit through pasture management. And now is the time to act. It will be too late to achieve any advantage if it is left to make a start when the season turns dry.

SCOURS IN CALVES.

The most common ailment of calves, and one of the chief causes of unthriftiness and mortality, is scours. The disorder may manifest itself in one of several forms—viz., common scours or scours caused by indigestion; blood scours; white scours. Preventive measures should always be observed in calf-rearing, for to cure it is a difficult matter.

Common scours or scours caused by indigestion, the most common type, is a digestive disturbance resulting from errors in management and feeding. The chief factors in its causation are:—

(1) Irregular feeding times;
(2) Feeding milk at improper temperatures;
(3) Over-feeding or under-feeding;
(4) Unclean feeding vessels, yards, or sheds;
(5) Sudden changes in feeding;
(6) Feeding sour or unclean milk;
(7) Too rapid feeding.

A failure to take food, indicating loss of appetite, or diarrhoea, should be regarded as presumptive symptoms, and if a calf shows these symptoms the above and other points in management should be carefully checked over and any necessary adjustment made. A common error in treatment is to immediately apply methods calculated to check the disorder, by administering astringents which have a binding effect. Instead of this, the bowels should be opened to get rid of offending material, and for this purpose castor-oil, given in doses of 1 to 3 oz., depending on the size of the calf, is suggested; at the same time, cut down the ration to half. While ordinary scours is not contagious, it is a good practice to separate sick calves from the others so that they may be watched and given proper treatment.

Blood scours, recognised by the bowel discharges being discoloured by blood, is highly contagious, and immediate isolation of the affected calves is therefore essential. A leaflet on this ailment is obtainable on application to the Department of Agriculture and Stock.

White scours is due to infection by a micro-organism, and attacks calves at birth or soon after they are dropped. Isolation is necessary to prevent the spread of infection to other calves in the herd. The destruction of dead carcasses by fire should be first done, followed by thorough disinfection of the shed and pen surroundings in which the infected animals had been kept. The local stock or dairy inspector should be consulted for further advice.

SELECTING A DAIRY HEIFER.

In the selection of a dairy heifer, the form and general character will, to a great extent, indicate whether she will develop into a good producer. When a heifer is quite young, the trained eye of the judge can see its dairy value and can discern the dairy type as distinct from the beef type. The production records of her ancestral dams on both sides are important factors in determining her future dairy value, while constitution is also important.

The form of the heifer with a future as a profitable producer is, in miniature, that of a good type, fully-developed dairy cow. Dairy characteristics are indicated by an absence of surplus flesh; she is somewhat angular and spare. The head is typical of her breed, the eyes large and bright, and muzzle large, ears of average size, neck lean and lengthy, sloping with the shoulders. She is sharp over the shoulders, ribs well sprung, with good heart girth. The forequarters are light. Digestive capacity is indicated by the depth through the barrel from the centre of the back to the navel. Good depth indicates ample capacity to convert food into milk. The greater the depth through the middle the greater the production is likely to be. The back is straight. There is a good length from the hip to the pin bones, and from the hip to the flank. The thighs are flat and free from fleshiness; the line of the thigh is incurving. The bones should be light and not coarse. The tail should be thin and free from flesh. All of these points should indicate that there is no tendency to lay on flesh.

The udder (as yet undeveloped), milk veins, and wells are reliable indications of the heifer's future value as a dairy cow. The skin covering and surrounding the immature udder is soft and loose with teats well placed. The milk veins can be followed with the finger and milk wells gauged. Comparatively well-developed milk veins and large milk wells also are important points in judging a dairy heifer.

Name and Address.	Name of Hatchery.	Breeds Kept.
F. J. Akers, Eight Mile Plains ..	Elmsdale ..	Australorps
W. Brown, Waterworks road, The Gap, Ashgrove	Strathleven ..	White Leghorns
W. T. Burden, 44 Drayton road, Toowoomba	Harristown ..	White Leghorns, Australorps, and Rhode Island Reds
J. Cameron, Oxley Central ..	Cameron's ..	Australorps and White Leghorns
M. H. Campbell, Albany Creek, Aspley	Mahaca.. ..	White Leghorns and Australorps
W. C. Carlow, Brookfield ..	Adaville ..	Australorps, White and Brown Leghorns
J. L. Carrick and Son, Manly road, Tingalpa	Craigard ..	White Leghorns and Australorps
J. E. Caspaney, Kalamia Estate, Ayr	Evlinton ..	White Leghorns
W. Chataway, Cleveland ..	Wilona ..	White Leghorns and Australorps
N. Cooper, Zillmere road, Zillmere	Graceville ..	White Leghorns
R. B. Corbett, Woombye ..	Labrena ..	White Leghorns and Australorps
Mrs. M. M. Cousner, The Gap, Ashgrove	Progressive Poultry Farm	Australorps and White Leghorns
Dr. W. Crosse, Musgrave road, Sunnybank	Brundholme ..	White Leghorns, Australorps, Rhode Island Reds and Whites
O. M. Dart, Brookfield	Woodville ..	White Leghorns, Australorps, Langshans, and Rhode Island Reds
Dixon Bros., Wondecla	Dixon Bros. ..	White Leghorns
T. Duval, Home Hill	Athalie ..	White Leghorns and Rhode Island Reds
E. Eckert, Head street, Laidley	Laidley ..	Australorps, Langshans, and White Leghorns
Elks and Sudlow, Beerwah ..	Woodlands ..	White Leghorns and Australorps
F. G. Ellis, Old Stanthorpe road, Warwick	Sunny Corner ..	Australorps
B. E. W. Frederich, Oxley road, Corinda	Glenalbyn ..	Australorps
W. H. Gibson, Manly road, Tingalpa	Gibson's ..	White Leghorns and Australorps
Gisler Bros., Wynnum	Gisler Bros. ..	White Leghorns
J. W. Grice, Loch Lomond, via Warwick	Quarrington ..	White Leghorns
C. and C. E. Gustafson, Tannymorel	Bellevue ..	White Leghorns, Australorps, and Rhode Island Reds

Name and Address.	Name of Hatchery.	Breeds Kept.
F. E. Hills, Sims road, Bundaberg	Littlemore ..	Rhode Island Reds, Australorps, White Wyandottes, White Leghorns, and Langshans
A. E. Hoopert, Greenwattle street, Toowoomba	Kensington ..	Australorps, Rhode Island Reds, and White Leghorns
C. Hodges, Kuraby	Kuraby ..	White Leghorns and Anconas
A. E. Hoopert, 24 Greenwattle street, Toowoomba	Kensington ..	Australorps and Rhode Island Reds
H. Huischmid, Ellison road, Geebung	Meadowbank ..	White Leghorns, Brown Leghorns, Minorcas, Australorps, and Rhode Island Reds
Miss K. E. Jenkins, Phillip street, Sandgate	Brooklands ..	Australorps, White and Brown Leghorns
S. W. Kay, Cemetery road, Mackay	Kay's Poultry Stud	White Wyandottes, Light Sussex, Rhode Island Reds, Australorps, White and Brown Leghorns
W. A. Lehfeldt, Kalapa ..	Lehfeldt's ..	Australorps
F. W. R. Longwill, Birkdale ..	Nuventure ..	Australorps, White Leghorns, and Light Sussex
J. McCulloch, Whites road, Manly	Hinde's Stud Poultry Farm	White and Brown Leghorns and Australorps
W. S. McDonald, Babinda ..	Redbird ..	Rhode Island Reds and Anconas
F. W. McNamara, Vogel road, Brassall, Ipswich	Franmara ..	White Leghorns and Australorps
A. Malvine, Junr., Waterworks road, The Gap, Ashgrove	Alva	Australorps and White Leghorns
H. L. Marshall, Kenmore ..	Stonehenge ..	White Leghorns and Australorps
W. J. Martin, Pullenvale ..	Pennington ..	Australorps, White and Black Leghorns
A. E. Mengel, Campbell street, Toowoomba	Glenmore ..	White, Black, and Brown Leg-Leghorns, Anconas, Australorps, and Rhode Island Reds
C. Mengel, New Lindum road, Wynnum West	Mengel's ..	Australorps
J. A. Miller, Charters Towers ..	Hillview ..	White Leghorns
F. S. Morrison, Kenmore ..	Dunglass ..	White and Brown Leghorns and Australorps
Mrs. H. I. Mottram, Ibis avenue, Deagon	Kenwood Electric	White Leghorns
J. W. Moule, Kureen	Kureen ..	Australorps and White Leghorns
D. J. Murphy, Marmor	Ferndale ..	White and Brown Leghorns, Australorps, Silver Campines, and Light Sussex
S. V. Norup, Beaudesert Road, Coopers Plains	Norups	White Leghorns and Australorps
C. O'Brien, Hugh street, Townsville	Paramount ..	White Leghorns and Rhode Island Reds
H. Obst and Sons, Shepperd ..	Collegeholme ..	White Leghorns and Rhode Island Reds
A. C. Pearce, Marlborough ..	Marlborough ..	Australorps, Rhode Island Reds, Light Sussex, White Wyandottes, and Langshans
E. K. Pennefather, Douglas street, Oxley Central	Pennefather's ..	Australorps and White Leghorns
G. Pitt, Box 132, Bundaberg ..	Pitt's Poultry Breeding Farms	White Wyandottes, White Leghorns, Brown Leghorns, Australorps, Rhode Island Reds, Langshans, and Light Sussex
G. R. Rawson, Upper Mount Gravatt	Rawson's ..	Australorps
J. Richards, P.O., Atherton ..	Mountain View	Leghorns and Australorps
W. G. Robertson, Bilsen road, Nundah	Ellerslie ..	Australorps, Light Sussex, and Plymouth Rocks
C. L. Schlencker, Handford road, Zillmere	Windyridge ..	White Leghorns

Name and Address.	Name of Hatchery.	Breeds Kept.
S. E. Searle, New Cleveland road, Tingalpa	Tingalpa Stud Poultry Farm	White Leghorns and Australorps
W. B. Slawson, Camp Mountain	Kupidabin ..	White Leghorns, Australorps, and Light Sussex
Mrs. A. Smith, Beerwah.. ..	Endcliffe ..	Australorps and White Leghorns
A. T. Smith, Waterworks road, Ashgrove	Smith's ..	Australorps and White Leghorns
T. Smith, Isis Junction	Fairview ..	White Leghorns and Australorps
H. A. Springall, Progress street, Tingalpa	Springfield ..	White Leghorns
A. G. Teitzel, West street, Aitkenvale, Townsville	Teitzel's ..	White Leghorns and Australorps
W. J. B. Tonkin, Parkhurst, North Rockhampton	Tonkin's ..	White Leghorns, Australorps, and Rhode Island Reds
P. and K. Walsh, Pinklands, via Cleveland	Pinklands ..	White Leghorns
W. A. Watson, Box 365 P.O., Cairns	Hillview ..	White Leghorns
G. A. C. Weaver, Herberton road, Atherton	Weaver's ..	Australorps, White and Brown Leghorns, Anconas, Minorcas, Rhode Island Reds, Indian Game, and Bantams
H. M. Witty, Boundary road, Kuraby	Witty's ..	White Leghorns and Anconas
P. A. Wright, Laidley	Chillowdeane ..	White Leghorns, Brown Leghorns, and Australorps

BLACK COMB IN FOWLS.

Black comb disease in poultry occurs frequently throughout the State from October to March. It usually affects laying hens, and is responsible for heavy losses to the industry either by death or decreased egg production.

Where treatment is prompt the mortality does not appear to be as extensive as when treatment has been delayed. Again, early treatment appears to assist in getting affected birds back into production much more quickly than when it has been deferred.

The first indication of the disorder is a bird's pronounced loss of appetite, followed in the course of a few hours by a darkening of the comb. In fact, it is not uncommon for 25 per cent. of the flock to have a very darkened comb within twenty-four hours of the first sign of the trouble.

In the early stages of this disease, the temperature of sick birds rises. This induces thirst. As the disease develops, little desire for water is in evidence, and as treatment for this trouble is given by means of the drinking water, the necessity for prompt action is obvious.

On further examination of the sick birds it will be found in most cases that the crop is full an indication of the suddenness of the attack. This condition of the crop has caused many breeders to attribute the trouble to the food and water. As the disorder advances the legs of the Leghorns particularly become very much darkened in colour; and if the feathers of a bird of any breed are turned back, the skin will be found to be darker than usual. Diarrhœa has been observed in some cases, but it is not apparent in all affected flocks.

The mortality from this disorder appears to be governed largely by the general condition of the flock, and the rapidity with which treatment is applied. Where prompt measures have not been taken, losses have been as high as 20 per cent.; but where early treatment is given deaths have been as low as 1 or 2 per cent. The loss from deaths, however, is not the only important factor. Egg production has been observed to fall from 60 to 5 per cent. within six or seven days.

Treatment.—Several proprietary mixtures are used with apparently beneficial results, but in preference to deferring treatmnt until these mixtures are procurable, the breeder is recommended to administer Epsom salts to the birds in the drinking water at the rate of 1½ to 2 oz. to the gallon.

Establishing Lucerne.

LUCERNE is grown for hay purposes chiefly in warm districts on deep calcareous soils provided with abundant moisture. In such situations heavy crops are produced over a number of years. Within recent years the cultivation of lucerne has been extended into fairly dry districts, but most success may be expected on soils rich in lime and with ample moisture available to the plants.

Land intended for lucerne is best cropped with a cereal—such as wheat, oats, barley, or rye—or panicums and millets—prior to its preparation for lucerne. Stubbles should be cultivated to induce volunteer growths of weeds and other seeds; these should be turned in subsequently by ploughing. For a first cultivation, two deep ploughings should be given at right angles to each other. Moisture should be conserved by frequent cultivation. In dry districts, where a good rainfall cannot always be depended upon at seeding time, fallowing is particularly necessary for the purpose of conserving moisture. The land may therefore be ploughed in late autumn or early winter the year before it is intended to sow. The depth of the ploughing is governed by the character of the soil. Alluvial soils should be ploughed to a depth of about 7 inches, but on other classes of soil of lighter or more porous nature a depth of 4 to 5 inches is sufficient. The ploughed land should then be allowed to lie in the rough state for a month or so and be broken down with harrows after summer rains. During summer the land should be frequently worked with harrows or cultivators, so as to allow neither growth of weeds nor the formation of a hard crust on top. If the seed-bed cannot be worked down sufficiently fine with the harrows, a one-way disc cultivator or roller will do all that is necessary. If the land is rolled, it should be harrowed immediately after the rolling. Where the soil surface shows a tendency to dry out just prior to sowing, a light ploughing may be given and followed by the harrows. Sowing on top of the harrowed surface, followed either by a light rolling or by brush-harrowing, is a good practice—but if rolling is adopted, a set of light harrows should be used immediately afterwards. Rolling assists in bringing the soil particles in closer contact with the seed and works in the same manner as compressing a partly dried-out sponge.

Lucerne is best sown in April or May, the young plants then being sufficiently well established before the onset of cold weather to enable them to survive. Provided the seed is drilled in, a sowing rate of 12 to 14 lb. per acre is ample, and often too much, in the best lucerne-growing districts. If hand broadcasting is practised, slightly more seed should be used. The rate of seeding should be lighter in dry districts, and for grazing purposes a seeding of as low as 2 lb. per acre is permissible. Seed sown on the surface should be covered by means of a light harrowing.

Though fertilizers are not used to any considerable extent in the main lucerne-growing areas, many growers have obtained payable results by applying up to 1½ cwt. of superphosphate per acre, either drilled in with the seed or used as a top-dressing. Nitrogenous fertilizers appear unnecessary.

Fully a month or six weeks will pass before the young root system becomes established and the lucerne is fit for its preliminary cutting by the mower. An

early mowing before the young lucerne flowers acts as a pruning and stimulates the root growth. After the preliminary cutting, a light harrowing may be made if absolutely necessary because of foreign growths.

Often promising stands of lucerne, following good germination, are destroyed through cutworm attacks. Damage at this time is irreparable, for the blank spaces are filled with weeds which considerably lessen the value of the crop. The Paris green-bran cutworm bait broadcast at the rate of 30 lb. per acre gives effective control, provided it is distributed as soon as the depredations of the pest become apparent. The necessary materials should therefore be held in stock on the farm for emergency. Cutworms attack only very young lucerne and intelligently applied baiting is then quite safe. Bait distribution in established crops is undesirable on account of the possible risk of stock poisoning.

PREPARATION OF WHEAT LAND.

Widely distributed rains since December have enabled farmers to go on with the preparation of wheat lands. Fields ploughed during December will now be in good physical condition, provided weed growth has been controlled by judicious cultivation.

Where sheep have access to the fallowed areas weeds will not be troublesome, but elsewhere every effort should be directed towards the eradication of all such growths. If it has been possible to control weed growth, all workings following the initial ploughing can be done entirely with rigid tine cultivators, or spring-tooth implements, and with harrows. Cultivation to the desired depth in order to break the crust and form a good surface mulch should be done soon after all substantial rains. As a firm seed-bed is required, it is important to progressively reduce the depth of working towards seeding time, particularly where sheep are not available to assist in consolidation.

Well prepared land containing ample reserves of moisture is often fit for sowing at a seasonable period, according to the variety selected, independently of favourable rains. On the other hand, hurriedly prepared land may have to await later rains to effect germination—a great disadvantage, for early or seasonably sown crops invariably give the best average returns.

The wheat yield for the 1937 season exceeded the average annual return for the previous decade, despite somewhat adverse seasonal conditions, a fact which can be attributed largely to the increased attention being given to the thorough preparation of the land. The growers who consistently practise summer fallowing have been amply rewarded for their efforts during recent years when winter and spring rains have been under average, a fact which cannot have escaped the attention of neighbouring farmers.

Where wild oats and other weeds are assuming pest proportion, it is suggested that the land be sown to a good fodder oat, which can be grazed as required, ploughing in the residue in sufficient time to prevent the maturity of wild oat seed.

Weed infestation during the following year can thus be greatly reduced, besides providing valuable feed, and a rotation crop of benefit to the land.

WINTER AND SPRING FODDER CROPS.

For winter and spring feed in coastal areas which have a fair winter rainfall, the winter cereals, wheat, oats, barley, and rye, are strongly recommended. If these crops are combined with a legume such as field peas or vetches, the nutritive value of the fodder is greatly enhanced.

Sowings of these crops may commence now, with successional sowings during May, if desired. If seasonal rains are delayed, sowings may be extended to early July, but with such late sowings the crops will only be available for a short period.

In the absence of seed drills, broadcasting is usually adopted, sowing the legume first, and discing or cultivating in; following with the cereals which are broadcast and harrowed in.

Suitable varieties are Florence, Warren, or Warchief wheat; Sunrise, Belah, or Algerian oats, and Skinless barley. Florence wheat, 30 lb., combined with Dun field peas at the rate of 20 lb. per acre, has proved a suitable mixture, as both are early maturing. Algerian oats, 30 lb., combined with vetches at the rate of 20 lb. per acre, is also a suitable combination, particularly for early sowing, as this mixture is considerably slower in maturing than the former. The early maturing varieties of oats, such as Belah and Sunrise, may also be sown with field peas if desired.

If individual crops are sown, the following rates of seedling per acre are recommended; wheat 60 lb., barley 50 lb., oats 50 lb., rye 50 lb., field peas 40 lb., vetches 30 lb.

The crop should be cut and fed direct to stock as, where grazing is practised, wastage occurs through trampling.

Rape may also be grown during the autumn and winter months to provide an abundance of succulent feed, which is particularly fattening for both sheep and pigs. Rape is not so suitable for dairy cattle, owing to the taint which it sometimes may impart to milk, and to its tendency to induce bloat.

Rape may be sown from March to May, drilling in 4 to 5 lb. of seed per acre. Broadleaf Dwarf Essex is the variety favoured.

The root crops, mangels, sugar beet, Swede turnip, and kohl-rabi, may also be sown on well prepared land from February until May.

A "Planet Junior" cultivator and seeder is a useful implement for this work, the seed being sown in rows 2½ feet apart, and the plants being thinned out to 1 foot intervals. Sow mangels and sugar beet at the rate of 5 to 7 lb. per acre, Swede turnips 2 to 3 lb., and kohl-rabi 2 lb.

THE SWEET POTATO.

The sweet potato is not cultivated in Queensland to-day to the extent that its usefulness warrants. At one time it was used largely on the householder's table, but it is now a rarity.

When questioned about the shortage of sweet potatoes for table use, the farmer usually replies, "There is no demand for them." This is true only in part, but the demand still exists for the right varieties. A dry floury, or a moderately moist, potato will suit the consumer best. No doubt, some of the good varieties in use in the past are not now available, owing to droughts and irregular planting, but many are still to be found in certain localities. If the planting is confined to varieties which have proved popular with the consumer, and which could be sold on name, the demand for them should be continuous. Under present conditions a householder may buy sweet potatoes which are unpalatable. If, however, consumers realised that there were different types and varieties of sweet potatoes, they would learn very soon to purchase only types which they liked.

Market gardeners should, therefore, cultivate varieties for which they could readily find buyers. Some market gardeners are already doing this with good results. Very watery or stringy varieties are both undesirable. It is a mistake for a grower to allow a portion of his crop to stand over after maturing, as the tubers then begin to deteriorate in quality.

Sweet potatoes are easy to grow, and can be raised on a variety of soils, the period of growth from planting to harvesting being approximately three months. The period of planting is dependent very largely on the locality; in most parts along the coast it may extend from October until the end of February. The crop must mature before the frost commences. The crop does not require a big rainfall —in fact, excessive moisture is detrimental to good results, in that it increases the growth of vines, and lessens the crops of tubers.

The most satisfactory method is to plant a few medium-sized tubers in a nursery bed of good friable soil, which is mulched in order to retain moisture and promote rapid growth, and to pick cuttings as growth progresses. A bed of fifty selected tubers planted in this way will provide many thousands of cuttings. The alternative, and less satisfactory, method of obtaining planting material is to procure cuttings from an old plot, which is usually neglected. The terminal cutting from the vine is generally regarded as giving the best results. The land is set up in ridges 3 feet apart. The cuttings should be 12 to 15 inches in length, and planted on the ridge to a depth of approximately 6 inches, cuttings to be set from 20 to 24 inches apart. On well-prepared soil weeds should not be troublesome, and little attention will be necessary until harvesting.

A good crop of sweet potatoes will yield 20 tons of tubers to the acre. Several of the old varieties were known by different names in various districts. A classification of all varieties grown in Australia was carried out in recent years by an officer of the Department of Agriculture and Stock, and cuttings of a known type, together with a number of new seedling varieties, were distributed in different agricultural districts of the State. Some recommended varieties for planting for table use are Gold Coin, Seedling No. 3, Brook's Gem, and Snow Queen.

It is advantageous to the grower to market the tubers in a clean and attractive condition.

The Citrus Bud Mite.

CERTAIN types of malformation on citrus trees, known in Queensland orchards for many years and often attributed to red spider, are now known to be due to another and much smaller mite frequenting the buds. This mite, which closely resembles, and may be identical with, a similar pest recorded in New South Wales and California, has been termed the citrus bud mite.

The injury takes the form of a distortion of growing points, leaves, flowers, and fruits. Growing points are often twisted, leaves exhibit grotesque forms, flowers frequently do not open properly, and fruit may not set. A number of common fruit malformations, particularly of lemons, are probably due to this pest. Multiple budding is also a symptom of bud mite infestation, numerous short, rather weakly shoots, giving a characteristic bunched appearance to the young growth.

Microscopic examination of the buds shows a black or brownish discolouration of the scales and, on mature wood, the buds are frequently dead.

The mites themselves are very small worm-like creatures, about 1/200 of an inch in length and creamy-white in colour. The eggs are minute, spherical, and pearly-white. All stages of the mite are, of course, too small for detection by the naked eye. The mites are most numerous in the unopened buds, but occasional specimens have been seen on the outside of buds. At times, they are also abundant beneath the buttons of the fruit.

The mite has been recorded from a number of districts in coastal and subcoastal areas, ranging from Ayr in the North to Gayndah, Maroochy, and Maleny in the South, and it probably occurs in all the more important citrus districts of the State.

Damage has been particularly severe between spring and mid-summer during the last two years. Whether mite activity is normally at its maximum in the first half of the season is not yet known. In 1940, growth after the early February rains was quite normal in most areas and mites were far less prevalent at this time than in the previous October-December period. High temperatures cause a marked reduction in the mite population in New South Wales, and the very hot weather at the end of January (1940) probably had the same effect in Queensland.

Lemons in the Gayndah district and Solid Scarlet mandarins in the coastal areas have suffered most severely, but similar damage has been observed on at least a few trees of most varieties grown in the districts under observation. Mandarins, however, other than Solid Scarlets, appear to be less susceptible to injury than lemons, oranges, and grapefruit. The status of this newly-discovered

pest cannot yet be accurately assessed, but at present it may be considered of minor importance. The damage can, however, be serious in young trees for growth is checked and additional pruning is necessary to remove the many surplus shoots which, if allowed to develop, would ruin the plant.

The effect of the usual pest control measures on the mite is not yet clear. There is some reason to believe that the low dosage fumigation practised at times in the Gayndah district for the control of the larger horned citrus bug does not kill the mites. Sulphur dust appears to give a satisfactory kill and normal growth has been observed on heavily-infested trees after the application of a lime-sulphur spray during the spring. There is also some evidence to show that a dormant strength (1-15) lime-sulphur spray applied in late winter is an important factor in reducing bud mite damage in the following spring and summer. Until further information is available growers should on no account omit this spray from their pest control programme. In addition, if young growth at any time of the year shows symptoms of infestation, either a lime-sulphur spray (1-20 to 1-35, depending on the weather) or sulphur-hydrated lime dust (1-1) should be applied as a safeguard. If bud mite damage is evident on the spring growth of young trees in the nursery, the plants may be sprayed liberally with lime sulphur, as strong as the state of the trees and the weather conditions will permit.

THE CHOKO.

The choko is a popular vegetable, grown largely in Queensland for both market and home use. It has the advantage that, once planted, it comes into bearing each year from the original root. The plant will die down only during the coldest months, and in the spring will shoot again from the tuber which is formed under the ground.

The choko requires a rich loamy soil to which has been added a heavy dressing of well-rotted stable manure. Additions of dried blood and bone dust, or of manure during growth, are of great benefit, as, being a perennial and a heavy feeder, the choko's food requirements are considerable.

The method of planting the choko differs a great deal from that used for other varieties of the same family. Whole choko fruits are used as planting material, the growth coming from a shoot from the kernel in the fruit. The fruit should be planted on the side with the broad end sloping downwards and the stem end slightly exposed.

A trellis is essential to satisfactory growth, though, if planted near a fence or old stump, the plants will spread over it very quickly. When chokos are grown commercially it pays to erect a suitable trellis. This may be done with good logs or rough timber. Sometimes an ordinary "T" trellis is used, over which strong fencing wire is stretched.

A good permanent trellis may be constructed as follows:—Two rows of strong posts are set firmly in the ground with a height of about 6 feet 6 inches above the surface, the rows being about 9 feet apart and the posts about 8 feet apart in the rows. The tops of the posts support cross timbers on which strong fencing wire is stretched with about 18 inches between the wires to carry the vines. Stays support the outside posts, and wires for trellising also should be stretched upon these.

The choko takes some months to come into full bearing, but will commence to bear fruit generally some four to five months after planting. The plants appear to improve with age when properly cultivated and manured.

There are two varieties, the green and the cream. The cream-coloured variety is the more popular.

Chokos should be picked fresh and, after having been peeled, should be cut into suitable portions and boiled or baked.

FERTILITY OF THE HOME GARDEN.

Intensive gardening demands a higher degree of soil fertility than does ordinary field crop culture. An efficient system of soil management therefore should not only make allowance for the present crop but should aim at an ever-increasing reserve of fertility. To achieve this end a plentiful supply of organic matter is essential.

Organic matter improves both the physical condition of the soil and its water-holding capacity. It also helps to modify extremes of soil temperature. In

addition to providing some of the better known mineral constituents required by the plant, organic matter provides certain other necessary elements, usually not considered in the preparation of artificial fertilizers. Some heavy acid soils which fissure badly on drying can often be improved in texture by liming and the addition of organic matter.

The richer the food of animals the richer will be their excreta. Urine contains a great deal of the nitrogen and potash but only a small proportion of the phosphate excreted by the animal, and all three substances are in a form which is readily available for the plant. It is therefore important to realise that unless precautions have been taken to include the urine with the solid excreta the value of the manure is much less than it should be.

Horse manure is richer than cow manure, since the mineral requirements of the milking cow are much greater than those of the horse.

Poultry manure, when fresh, is a richer fertilizer than horse or cow manure. It contains more than twice as much nitrogen and phosphate, but has only about the same amount of potash. The bulk of its nitrogen is present in an easily available form, hence it is a quick-acting or forcing nitrogenous manure.

Animal manure, as commonly procurable, has not been carefully conserved, and must be regarded as an unbalanced fertilizer which should be supplemented by the application of artificial manures to the crop.

An annual application of 100 to 150 lb. per 100 square feet is usually necessary to maintain the fertility of the garden soil.

THE EGG PLANT.

The egg plant is easily grown and produces an excellent culinary vegetable. It is grown similarly to the tomato, and like that plant is very sensitive to cold. It requires a light, rich, loamy, well-drained soil, and poorer ground may be improved by the addition of a 1-4-1 mixture of sulphate of ammonia, superphosphate, and sulphate of potash at the rate of about 5 cwt. to the acre, or by heavy dressings of well-rotted stable manure to which a small quantity of superphosphate has been added.

For an early crop the seed may be sown under cover during July and August; and, when all danger of frost is over, the plants should be set out about 2 feet apart in rows 3 feet apart. Difficulty may be experienced with transplanting, and, it is sometimes desirable to sow the seed in the permanent positions for the plants after all danger of cold weather has passed.

Cultivation and plenty of water are necessary for the plants, as they do not recover readily after a check in growth. Staking in a similar manner to tomatoes may be practised, while, as soon as the fruits are formed, they should be thinned out to leave only eight or ten to each plant. The fruits are harvested when from 4 to 6 inches in diameter. The time from seed planting to transplanting is approximately two months, and from seed planting to mature fruit five months. The best variety is the New York Purple Spineless.

For cooking the fruit should be cut into slices and fried in butter, the slices having been covered first with salt. If being boiled or baked, the fruit should be seasoned with butter, pepper, and salt.

VEGETABLE CROP ROTATION.

The necessity for the rotation of crops in any particular plot of land must be patent to every observant market gardener. Not only does crop production fall off when the same crop is planted several times in succession, but pests and diseases frequently become worse in each succeeding crop.

In working out any system of rotation the following general rules may be taken as a guide.

1. Plants belonging to the same natural order should not succeed one another. For example, tomatoes, potatoes, and the egg plant belong to the same order, and should therefore not be grown after one another in the same land.

2. Plants grown for their roots or tubers should not be succeeded by others grown for the same purpose, as, for example, carrots, turnips, and beet.

3. Crops occupying the soil for a long period should be followed by quick-maturing crops.

THE FRUIT MARKET.

JAS. H. GREGORY, Instructor in Fruit Packing.

A STUDY of the markets in Southern capital cities shows clearly that the lessons of past years have not been heeded by every supplier. The usual winter batch of reports of immature pineapples, papaws, and tomatoes are coming to hand. Every Queensland grower should by now know the handicaps caused to his industry by attempting to market fruit not of the right maturity standards. Carry-overs and sluggish sales are the usual results, monotonous in their regularity. Time, labour, outlay, including transport costs, are all involved, so obviously only consignments which are welcomed by buyers should be sent. It is a waste of time, energy, and money to despatch unsaleable goods to any market. The timber supply also is involved, and fruit cases are too scarce to be used in conveying fruit to the dump.

Fruit does not colour and ripen at all satisfactorily outside the orchard fence in the winter time. It should, therefore, be left unpicked to colour; this has been proved both by experiment and practical marketing experience.

Many lines of papaws are arriving in Brisbane too green, and much fruit is wasted before consignments colour sufficiently for satisfactory sale. The same thing applies to pineapple consignments to Sydney and Melbourne. In the colder months of the year no risk of over-ripeness is entailed, so growers are strongly advised to let colour develop in the fruit before harvesting.

Prices during the last days of June were:—

TROPICAL FRUITS.

Bananas.

Brisbane.—Cavendish: Smalls, 8s. to 12s.; Sixes, 9s. to 13s.; Sevens, 9s. to 14s. 6d.; Eights and Nines, 10s. to 15s.; Bunch fruit, 2d. to 9d. per dozen.

Sydney.—Cavendish: Sixes, 10s. to 14s.; Sevens, 14s. to 17s.; Eights and Nines, 16s. to 19s.

Melbourne.—Cavendish: Sixes, 13s. to 15s.; Sevens, 14s. to 16s.; Eights and Nines, 15s. to 17s.

Adelaide.—Cavendish: 16s. to 18s. per tropical case.

Newcastle.—Cavendish: Sixes, to 14s.; Sevens, 15s. to 16s.; Eights and Nines, 16s. to 18s.

Brisbane.—Lady Fingers, 2d. to 10d. per dozen.

Brisbane.—Sugars, 3d. to 6d. dozen.

Pineapples.

Brisbane.—Smoothleaf, 4s. to 7s. case; 1s. 6d. to 4s. dozen; Ripleys, 3s. to 4s. 6d. case; 4d. to 2s. 6d. dozen.

Sydney.—Smoothleaf, 7s. to 10s. case; specials higher.

Melbourne.—Smoothleaf, 9s. to 11s.; specials higher.

Adelaide.—Smoothleaf, 15s. to 18s. case.

Newcastle.—Smoothleaf, 8s. to 10s. case.

Papaws.

Brisbane.—Local, 2s. 6d. to 4s. 6d. bushel; Yarwun, 4s. to 6s. tropical case; Gunalda, 4s. to 5s. bushel case.

Sydney.—7s. to 12s.; Special coloured lines higher.

Melbourne.—8s. to 12s. case; some lines green and unsaleable.

Newcastle.—10s. to 12s.

Custard Apples.

Brisbane.—2s. 6d. to 3s. 6d. per half-bushel. Demand steady for quality fruit.

Sydney.—4s. to 6s. per half-bushel.

Melbourne.—5s. to 7s. per half-bushel.

Newcastle.—4s. to 5s. per half-bushel.

Passion Fruit.

Brisbane.—First grade, 7s. to 11s.; seconds, 3s. to 6s.; slow of demand.

Melbourne.—Queensland, 10s. to 12s. half-bushel.

Strawberries.

Brisbane.—6s. to 10s. dozen boxes; specials, to 16s. dozen.

Sydney.—12s. to 21s. dozen boxes; trays, 3s. to 7s.; some adversely affected.

Newcastle.—14s. to 18s. dozen boxes; trays, 7s.

CITRUS FRUITS.

Oranges.

Brisbane.—Navels, 4s. to 8s. per case; Commons, 3s. to 6s. per case. Demand slow.

Mandarins.

Brisbane.—Emperors, 3s. to 8s.; Glens, 5s. to 13s.; Scarlets, 4s. to 8s.

Melbourne.—Emperors, 8s. to 11s.; Glens, 10s. to 14s.; Ellendales, 10s. to 14s. Heavier consignments coming forward from all States.

Grape Fruit.

Brisbane.—3s. to 7s. bushel.

Sydney.—6s. to 10s.; specials higher; large sizes wanted.

Melbourne.—7s. to 12s. bushel.

Lemons.

Brisbane.—6s. to 13s.; specials higher.

Melbourne.—7s. to 10s. bushel.

TOMATOES.

Brisbane.—Green, 1s. 6d. to 5s. half-bushel; coloured, 4s. to 8s. Green fruit is hard to sell, and a perusal of prices will show producers that money is lost through marketing green fruit.

Sydney.—Redlands, 3s. to 8s.; a few choice lines to 12s.; Bowen, 6s. to 10s.

Melbourne.—Queensland, 7s. to 8s.; repacked, to 10s.

Newcastle.—Green, 5s. to 6s.; choice coloured higher.

VEGETABLES.

(Brisbane prices unless otherwise stated.)

Beans.—10s. to 14s. sugar-bag; inferior lower; Sydney, 8s. to 15s. bushel; Newcastle, 5s. to 10s. case; Melbourne, 6d. to 7d. lb.; Adelaide, 10d. to 1s. dozen lb.

Peas.—10s. to 14s. sugar-bag; some specials higher.

Cauliflowers.—Small, 1s. to 3s. dozen; large, to 9s. dozen.

Cabbages.—2s. to 4s. dozen; prime quality, to 8s. dozen.

Carrots.—3d. to 1s. 6d. bundle.

Marrows.—1s. to 3s. dozen; sales slow.

Beetroot.—6d. to 1s. bundle.

Rhubarb.—6d. to 1s. bundle.

Cucumbers.—6s. to 8s. bushel case; 9d. to 2s. dozen.

Pumpkins.—3s. to 4s. bag.

Chokos.—4d. to 6d. dozen.

English Potatoes.—2s. 6d. to 5s. sugar-bag.

Sweet Potatoes.—1s. 6d. to 2s. 6d. sugar-bag.

PRODUCTION RECORDING.

List of cows and heifers officially tested by officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Books of the Australian Illawarra Shorthorn Society, the Jersey Cattle Society, and the Ayrshire Cattle Society, production charts for which were compiled during the month of May, 1941 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
AUSTRALIAN ILLAWARRA SHORTHORNS.				
Mature Cow (Standard, 350 lb.).				
Alfa Vale Model 4th (365 days)	W. H. Thompson, Nanango	19,106·25	847·215	Reward of Fairfield
Dorravista Peggy	J. F. Evans, Malanda	10,945·15	376·818	Monarch of Tarzali
Ruby of Hawthorn (254 days)	R. J. Couchman, Warra	9,372·71	374·373	General of Croydon
Junior, 4 Years (Standard, 310 lb.).				
Rocklyn Laura (222 days)	V. A. Wyvill, Yarralea, Upper Yarraman, *via* Yarraman	7,299·5	391·496	Kurrajong Reddie's Beau
Junior, 3 Years (Standard, 270 lb.).				
Navillus Vision 4th (365 days)	J. C. Meier, Mt. Mort	16,766·95	672·258	Alfa Vale Renell
Cedargrove Pearl 2nd	P. D. Fiechtner, Pilton View, Greenmount	7,185·5	271·337	Cedargrove Trump
Senior, 2 Years (Standard, 250 lb.).				
Pilton View Lady Prim	P. D. Fiechtner, Pilton View, *via* Greenmount	7,381	291·027	Navillus Venie's Sheik
Rocklyn Rose	D. Birch, Redleigh Stud, Memerambi	7,200·55	269·408	Kurrajong Reddie's Beau
Brooklands Mona	J. F. Wyvill, Middle Creek, Sarina	7,491	255·78	Springlands Kinsman
Junior, 2 Years (Standard, 230 lb.).				
Navillus Princess 8th	C. O'Sullivan, Navillus, Ascot, *via* Greenmount	7,033·5	294·296	Alfa Vale Prince Henry
Tara Tia 2nd	R. J. Knight, Barkworth, Milmerran	7,196·6	275·943	Murray Bridge Pansy's Gift
Braemar Annabelle	W. Henschell, Yarranlea, Pittsworth	7,947·86	274·926	Blacklands Gay Lad
Navillus Show Girl	C. O'Sullivan, Navillus, Ascot, Greenmount	7,171·25	273·062	Alfa Vale Prince Henry
Roshill Rosette 2nd	W. Flesser, Boyland	6,462·4	234·831	Dnalwon Count
Rocklyn Connie 2nd	D. Birch, Redleigh Stud, Memerambi	5,523·15	234·073	Chelmer Limelight

ERRATA.

The cow previously given as Navillus Daphne 2nd, should read :—

JUNIOR, 2 YEARS.

Navillus Daphne (273 days)	C. O'Sullivan, Ascot	7,332	295·512	Alfa Vale Prince Henry

The figures given for Alfa Vale Doris should read :—

MATURE COW.

Alfa Vale Doris (273 days)	W. H. Thompson, Nanango	14,972·95	665·182	Reward of Fairfield

JERSEY.

MATURE COW (STANDARD, 350 LB.).

Trecarne Jersey Queen 2nd	T. Petherick, Lockyer	9,450·2	571·105	Trinity Some Officer
Trecarne Chimes 2nd	T. A. Petherick, Lockyer	8,959·1	569·945	Trecarne Golden King
Glenmoore Jesters Maybell	J. and R. Williams, Glenmoore Stud, Kingaroy	7,564·25	430·385	Wheatlands Jester (Imp.)
Glenmoore Jesters Charm	J. and R. Williams, Glenmoore Stud, Kingaroy	7,660·65	415·864	Wheatlands Jester (Imp.)
Fauvic Double Gay	H. Cochrane, Fauvic, Kin Kin	7,084·95	390·606	Condong Double Prometheus
Annette of Calton	W. Bishop, Kenmore	7,636·12	366·762	Retford Glory's King 2nd

SENIOR, 4 YEARS (STANDARD, 330 LB.).

Trecarne Dairymaid	T. Petherick, Lockyer	9,584·45	701·236	Trinity Some Officer

JUNIOR, 4 YEARS (STANDARD, 310 LB.).

Iris of Gem	W. Bishop, Kenmore	9,848	504·653	Lace's Volunteer of Ardroy
Keystone Lavina	E. J. Keys, Proston	8,357·65	468·799	Gunawah Gamboge Prince
Bellgarth Bertha 3rd	P. Kerlin, Glenrandle, Killarney	5,103·2	313·977	Trecarne Renown 2nd

SENIOR, 3 YEARS (STANDARD, 290 LB.).

Trecarne Eileen 7th	T. Petherick, Lockyer	6,952·8	482·91	Trinity Some Officer
Prudence of Gem	W. Bishop, Kenmore	8,629·12	371·173	Lace's Volunteer of Ardroy

JUNIOR, 3 YEARS (STANDARD, 270 LB.).

Trinity Sheila 2nd	E. J. Keys, Proston	6,607·7	314·968	Trinity Royal Sovereign
Oxford Carmen	W. G. Berderow, Fairney View	4,765	275·837	Oxford Golden Peer

SENIOR, 2 YEARS (STANDARD, 250 LB.).

Trecarne Dairymaid 3rd	T. A. Petherick, Trecarne, Lockyer	6,280·9	426·497	Trecarne Victor 2nd
Overlook Bonnie Lena 2nd	J. Sigley, Millaa Millaa	5,619·25	250·000	Overlook Nancy's Bonaparte

JUNIOR, 2 YEARS (STANDARD, 230 LB.).

Oxford Lavender	E. Burton and Sons, Wanora	7,534·5	427·209	Oxford Peer
Glenview Rejoice	E. P. Fowler and Son Glenview, Coalstoun Lakes	4,776·6	282·494	Trinity Governor's Hope
Glenview Miriam	F. P. Fowler and Son, Glenview, Coalstoun Lakes	5,055·25	275·487	Trinity Governor's Hope
Glenview Starbright (255 days)	F. P. Fowler and Son, Glenview, Coalstoun Lakes	5,170·75	273·432	Trinity Governor's Hope
Maurfield Bravo's Hazel	G. Tilley, Beaudesert	5,182·9	267·893	Rosecliff Bravo's Master
Glenview Gaiety	F. P. Fowler and Son, Glenview, Coalstoun Lakes	5,047·1	236·893	Trinity Exchange

AYRSHIRE.

JUNIOR, 2 YEARS (STANDARD, 230 LB.).

Benbecula Gay Girl	M. J. Brownlie, Fairhill, Oakey	5,051·6	287·763	Myola Jean's Monarch

General Notes

Staff Changes and Appointments.

The following have been appointed cane testers for the 1941 sugar season at the mills specified:—Messrs. L. J. G. Becker (Racecourse Mill), C. J. Boast (Mount Bauple), T. V. Breen (Invicta), T. P. Brown (North Eton), L. Chadwick (Moreton), P. H. Compton (Mourilyan), T. F. Corbett (Fairymead), T. D. Cullen (Qunaba), L. G. F. Helbach (Proserpine), T. Herbert (South Johnstone), J. Howard (Rocky Point), H. C. Jorgensen (Tully), J. Macfie (Bingera), S. McRostie (Kalamia), P. J. Phelan (Inkerman), W. Richardson (Babinda), W. Trulson (Pleystowe), R. D. Woolcock (Maryborough); Mesdames L. Keane (Mossman), and E. Macaulay (Cattle Creek); and Misses D. Bowder (Millaquin), E. Christsen (Pioneer), A. L. Levy (Gin Gin), M. A. Lyle (Marian), M. A. Morris (Farleigh), I. Palmer (Mulgrave), and P. Thorburn (Isis).

The following have been appointed assistant cane testers for the 1941 sugar season at the mills specified:—Messrs. P. C. Boettcher (Kalamia), C. Boone (South Johnstone), A. Byrne (Moreton), L. C. J. Clifton (Tully), W. C. Cocking (Inkerman), H. R. Dark (Pleystowe), J. D. Kinnon (Pioneer), J. Mackenzie (Farleigh), C. M. Martin (Gin Gin), J. H. Murtagh (Maryborough), F. Pinch (Plane Creek), P. A. Van Lith (Proserpine), and S. Wilson (Maryborough); Mrs. M. E. Nally (Qunaba); and Misses A. Anderson (Millaquin), F. Atherton (Racecourse), K. Backhouse (Mulgrave), E. A. Crees (Bingera), P. G. Eadie (Babinda), F. Foubister (Pleystowe), K. M. O'Brien (Fairymead), M. Osborne (Mulgrave), E. M. O'Sullivan (Moreton), P. Southwick (Babinda), M. Whitla (Fairymead), S. Wilkinson (North Eton), and F. M. Wilson (Plane Creek).

Mr. S. T. W. Hartley, temporary inspector under *The Diseases in Plants Acts*, has been appointed an inspector, *Diseases in Plants Acts*, Department of Agriculture and Stock, Brisbane.

Mr. C. Schindler, inspector, *Diseases in Plants Acts*, Wallangarra, has been appointed also an inspector under *The Diseases in Poultry Acts*.

Sergeants J. E. Cunneen (Cardwell), J. C. Davis (Mundubbera), and Constables J. Geraghty (Wooroorooka), S. F. Brace (Cecil Plains), and R. E. Goodwin (Kuranda) have been appointed also inspectors under *The Slaughtering Act*.

Mr. T. Craik (Stewartdale, Ripley, via Ipswich) has been appointed an honorary protector under *The Fauna Protection Act*.

Messrs. W. J. J. Short (chairman of the Sugar Board), E. A. Crosser (Assistant Under Secretary, Treasury Department), and J. Seymour (Assistant Parliamentary Draftsman) have been appointed advisory members of the Queensland Emergency Supplies Committee.

Mr. R. P. Cross (Marmor) has been appointed an honorary protector of fauna.

Sergeant D. Wallace (Jundah) has been appointed also an inspector under *The Slaughtering Act*.

Messrs. M. R. Harrison (Margaret street, Toowoomba), J. McGregor (Cooby Creek, Kleinton), and F. Deuble (Wetalla) have been appointed honorary protectors of fauna.

Miss P. Southwick has been appointed a canetester for the present sugar season at the Inkerman Mill, Home Hill.

Mr. D. Walton has been appointed cane tester at the Plane Creek mill for the current sugar season.

Miss L. Beet has been appointed assistant cane tester at the Tully Sugar mill in place of Mr. B. N. Stuart.

Mr. P. B. McGovern, Assistant (Biometry), has been appointed Assistant Biometrician, Department of Agriculture and Stock.

Poisoning of "Weed" Trees and Undergrowth.

In a note under this heading in the May issue of the *Journal* it was stated that arsenic pentoxide is obtainable from the Prickly-pear and Noxious Weeds Section of the Department of Public Lands, Brisbane, at the concession rate of 5s. per 20-lb. tin, f.o.r. The price quoted should have read 7s. 6d. per 20-lb. tin, railage free to nearest railway station or siding.

Answers to Correspondents

BOTANY.

Replies selected from the outgoing mail of the Queensland Botanist, Mr. C. T. White, F.L.S.

"Stinking Rodger." A Thorn Apple Species.

R.T.M. (Chinchilla)—

The plant with the "minty smell" is Stinking Roger (*Tagetes glandulifera*). This plant is very common as a weed on coastal farms, but in recent years, especially during the past good season, has made its appearance as far west as the Warrego district. It is an aggressive farm weed, and as you have only a small patch its eradication is recommended.

The plant with the prickly pod is *Datura ferox*, a species of Thorn Apple or Stramonium. Plants of this genus are generally regarded as poisonous to stock. Most of the poisonous property is found in the seeds. As your particular species is a very bad pest in some parts of the Darling Downs and Maranoa districts, and as you say you have only a small patch of it, its eradication is recommended.

A Native Grape.

H.F.N.F. (Toowoomba)—

The specimen is a native grape (*Cissus hypoglauca*). This is moderately common in some of the scrubs of south-eastern Queensland. The berries are not known to be poisonous, but are very astringent. They also have a somewhat irritating effect on the mouth and tongue, due probably to the presence of crystals of calcium oxalate, which occur in the fruits of several native grapes.

Luminous Plants.

W.P. (Nambour)—

I am in receipt of your letter of the 5th instant. The light given off by the fungus you observed is due to a property of certain plants and animals, called chemoluminescence. This term in itself does not give one much information about the origin of the light, except that it indicates that the light is due to a chemical reaction. In addition to certain fungi several kinds of bacteria and some animals such as fireflies have the property of emitting light. Those who have investigated the subject consider that the light emitted in fungi, bacteria, and animals is derived from a similar source in each instance. From luminescent animals a substance called *luciferin* has been isolated. Luciferin is described as a nucleo-albumin-like substance and would, therefore, be similar, in a chemical sense, to one of the principal constituents of egg yolk. Luciferin, or a substance like it, is considered to be present in luminescent plants. The luciferin or luciferin-like substance becomes luminescent when it is acted upon or oxidised by an enzyme. The process is connected with respiration or the energy-liberating process in the luminescent plants and animals.

Many of the luminescent bacteria are found in decaying wood. Several years ago, when we were at Mount Spec, near Townsville, we were delighted by the spectacle of the rain-forest floor alongside the tracks being luminescent. All of the debris from the trees covering the forest floor was glowing with the peculiar silvery light.

The bell-shaped fungus you describe sounds like a species of *Thelephora*, which occurs in the shape of megaphones of varying sizes on logs If you wish to be sure of its identity it would be best to send us a specimen.

Thorn Apple.

E.S. (Glenore Grove)—

The specimen is *Datura stramonium*, Thorn Apple, also known as Stramonium. It is sometimes called Castor Oil Plant, but is quite different from the true Castor Oil, which is also naturalised in Queensland. All parts of the plant are poisonous and deaths of working horses are known to have been caused by chaff containing datura stalks and seeds.

A Rattlepod.

O.L.H. (Rockhampton)—

The specimen of legume is *Crotalaria striata*, a rattlepod. This plant has a very wide distribution over the tropics, and in India and Ceylon is sometimes grown as a green manure for tea. The plant has been condemned in Queensland at different times of poisoning stock, but so far as we have observed it is eaten to a very limited extent. Feeding experiments at Darwin showed the plant to be the cause of deaths of goats about the town. The poisonous principle is apparently destroyed by drying, as it was found the plant lost all its toxicity even after being cut for a few hours. The bark has a strong fibre.

Black Wattle. "Evolvulus."

K.E. (Chinchilla)—

The specimens forwarded with your letter of the 10th instant have been identified as under—

1. *Acacia Cunninghamii*, named after Allan Cunningham, the botanist-explorer of the Darling Downs. It is commonly called Black Wattle in Queensland, though in New South Wales this name is given to a very different species.

2. *Evolvulus alsinoides*, a small plant of the Convolvulus or Morning Glory family, for which I have not heard a common name. The generic one, "Evolvulus," however, is short enough for general usage. We have a native Forget-me-not but it is quite a different plant. The flowers are rather insignificant but otherwise quite similar to the Chinese Forget-me-not cultivated in gardens.

I would be very pleased to name any specimens you care to send from time to time.

Grasses Named.

C.E.T. (Boompa)—

1. *Bothriochloa intermedia*, Forest Blue Grass. This is an excellent all round pasture grass, especially for cattle, in the mixed native pasture in Queensland. In many localities it is the dominant species.

2. *Capillipedium parviflorum*, Scented Top. A grass rather similar to the last, but coarser, and probably not so valuable.

3. No seed-heads on this specimen, but we should say it is the Bunch Spear Grass (*Heteropogon contortus*). This grass is liked by stock in its young stages, but it soon becomes harsh and unpalatable and possesses a rather nasty "spear" seed. The name "bunch spear" comes from the fact that the seed-heads often become entangled to form clumps or bunches.

A Native Vine.

C.T. (Brisbane)—

The specimen collected at Cooloolabin, near Yandina, is *Freycinetia propinqua*, one of the handsomest of our native vines. It belongs to the Screw Pine family (Pandanaceae), of which two genera are found in Australia—namely, Pandanus (trees) and Freycinetia (vines). The genus commemorates Louis de Freycinet, the famous French navigator, who visited Australia in 1819.

"Shot Grass" or "Sago Grass."

R.S.D. (Augathella)—

The specimen is the Shot Grass or Sago Grass (*Paspalidium globoideum*). This grass has a very wide distribution in Queensland, especially on black soil country. It is an excellent fodder, relished by all classes of stock, both in seed and in the young stage. Once introduced, it tends to spread naturally. All seed-eating birds are very fond of the grass and take a heavy toll of the seeds.

"Finger Flower."

H.S. (Stanthorpe)—

The specimen is *Cheiranthera linearis*, a small plant of the Pittosporum family (*Pittosporaceae*), with a fairly wide distribution in Eastern Australia, but nowhere very abundant. "Finger Flower" is the local name that has been adopted, though we cannot quite see its application, and such a beautiful plant seems worthy of a more distinctive common name.

Wormseed.

G.R.S. (Biggenden)—

The specimen is Wormseed (*Chenopodium ambrosioides*). This is a widely-spread weed. The fruit is official in the United States Pharmacoepocia, and the oil from it (Oil of Chenopodium) is used as an expellent of worms. As a rule, this plant is only sparsely scattered, and is occasionally eaten, but not to a very great extent. If extensively eaten, it would probably be harmful.

VETERINARY ADVICE.

Bloat in Cattle.

E.G. (Nerang)—

It would appear likely that the condition you describe in cattle following feeding with the cowpea is simply hoven or bloat, and not prussic-acid poisoning.

Bloat is treated by puncturing the most prominent part of the swelling on the left side with a trocar and canula, removing the trocar, leaving the canula in position, which allows the gas to escape. If trocar and canula are not available, stabbing with a pocket knife is effective. If the condition does not recur the animal may be given a powder consisting of Nux vomica, ½ oz.; Ammonium carbonate, ½ oz. Mix the powder with treacle and place on the back of the tongue. Give one powder night and morning until six powders have been given.

Mammitis Veterinary Advice.

E.T.G. (Baralaba)—

Mammitis may be caused by (*a*) germ infection; (*b*) injury. Of these, the first cause is by far the more serious. Usually, the udder becomes warm and hard and the milk secretion curdy, and sometimes mixed in it is a little blood.

Treatment—

1. Isolate the affected animal, milk her last, and the affected quarter or quarters last of all;
2. Care should be exercised that the hands are washed immediately after handling the affected udder;
3. Strip the udder three or four times a day;
4. Apply massage at each milking for ten minutes or a quarter of an hour each time. Camphorated oil may be used for this treatment;
5. If used in the early stages vaccines may be of value, and, should you require a vaccine, it could be obtained from the Animal Health Station, Yeerongpilly, at a small cost, provided a sample of infected milk is sent, with a covering letter.

To procure the sample, firstly clean a small bottle and boil it for ten minutes with a cork in it. After rejecting the first few squirts of milk, take a sample of the udder milk into the bottle and send it to the Animal Health Station, Yeerongpilly, by the first available mail. From this a vaccine can be made.

"Queensland Itch."

A.M. (Lawgi, near Rockhampton)—

1. The condition you refer to is known as "Queensland itch." This disease is peculiar to Queensland and is usually seasonal in nature, occurring mostly at the change of seasons—i.e., autumn and spring—although it may be seen at any time.
2. The condition is not parasitic in nature, nor is it contagious, but as the exact cause is still obscure no definite cure can be recommended.
3. Relief should be given to the horses by washing them with a solution of *potassa sulphurata* (a drug obtainable from your chemist) containing 1 oz. of *potassa sulphurata* to 1 gallon of water.
4. This wash is highly irritant to bare skin—as around the eyes, the mouth, and under the tail—and, hence, care should be exercised in washing the horses.

Rural Topics

Uses for Old Rubber Tyres.

Here are some interesting uses to which old motor tyres may be put.

One farmer has two standing permanently beside his shed. When he returns from town with heavy loading that it is unwise to bump, he rolls out a tyre and drops the article on to it from the side of his lorry. The resiliency of the tyre takes up the jar, and so makes the task of unloading quite a simple matter. Another farmer has cut a strip out of the edge of a tyre and uses it as a creep for his young pigs.

Tyres adapted to hold water are common in many poultry yards, but the idea of a farmer who, by selecting a small tyre, cutting it through at one place and threading it on to a chain, has made an excellent spring to shut a gate.

A useful suggestion is behind another farmer's thought. He cut a section from a tyre and almost buried it where a much-used farm gate usually swings when open. By forcing the gate over the tyre, he is able to retain it in an open position. By merely standing on the highest point of the tyre, it is squeezed down and the gate can be closed.

An easy way to burn out an old tree stump is to place an old motor tyre round it and set alight to it all round the circumference. The tyre, or two, if necessary, can be cut at one side so that it can be placed in position.

An attractive appearance has been lent to a New Zealand farmer's entrance drive. He has planted an herbaceous border along both sides, and has laid out wide strips beyond the border in shrubs. Right from the cattle stop gate, he has two parallel rows of old tyres painted white to tone in with similar parallel rows of white-washed stones. Each of these tyres encircles a shrub with the earth heaped toward the centre. They not only hold the earth, but prevent grass from encroaching. —"The New Zealand Farmer Weekly."

Butter Fat Instead of Butter for Export.

The newest idea in saving export shipping space is what is called the re-separation of butter, and the New Zealand Dairy Research Institute has been experimenting successfully with this new technical process. In this re-separation the butter is dissolved to liquid by steam and then run through an ordinary cream separator, which extracts the water, casein, and other substances, leaving only the pure fat. This fat can then be packed in tins and shipped abroad without refrigeration. The extraction of the water and other things also reduces the weight of the product by about 18 per cent. This fat, which can be sent by ordinary cargo ships, can not only be turned into normal butter very easily, but can also be used in the making of margarine. That means, of course, that in its use in making up butter substitutes the dairy industry is not left out entirely.

Trees on the Farm.

On our farm lands and pastoral country trees have many valuable purposes. They can be grown as windbreaks and shelter belts; dotted round a run they provide shade and shelter for stock; they provide a reserve supply of fodder for a dry time; properly lopped, they keep the woodheap supplied; they are useful as screens round dams and tanks to prevent their silting up with dust and undue evaporation of water; they prevent erosion on slopes and along the banks of creeks and rivers, and add to the value and appearance of the farm home.

"An Apple a Day" for the Cow.

Here is something that will interest Stanthorpe apple-growers.

By tests at an agricultural experiment station in the States, it has been established that the dry matter of apples as feed for cows has about the same feeding value as that of corn silage. In New Zealand, as well as in America, dairy farmers have found the value of chopped apples in conjunction with bran as a feed for cows, especially in the late summer. The apples are put through a slicer, and, with a small quantity of bran, fed to cows immediately after milking, so as to avoid the risk of any abnormal flavour in the milk or cream. A reasonable ration is 20 lb. a day.

That is certainly one good way of making use of fruit that, under present circumstances, becomes in some times of the year a glut on the market.

Training a Sheep Dog.

A correspondent of *The New Zealand Farmer Weekly* asked in a recent issue for answers to the following questions:—

(1) In a good many cases the dog crouches when approaching the sheep; is this correct? (2) Should the dog at any time bark? (3) With defiant sheep, should the dog stand his ground or retire and let the sheep turn themselves? (4) What is the difference between long and short head?

"C.H." replied—

The reader who inquires for information on training his young dog for trials is in the position of many other enthusiasts. The young dogs show the necessary qualities for success, but these must be brought under the control of the trainer, while unsatisfactory habits must be eliminated and the more desirable qualities fully developed. To do this with the young dog just starting to work requires patience and also a definite plan of campaign. The importance of various qualities must be placed in their proper perspective.

For instance, the reader inquires whether his dog should maintain his crouching attitude in approaching sheep or not. The rights and wrongs of this method of approach are outweighed by the more important aspect of the attitude of the dog toward the sheep. Any approach that is bold is good. Naturally there is nothing bold about an approach that takes place with the dog's abdomen sliding along the ground, but a crouch denotes instant readiness for a quick movement in any direction, and is, therefore, good, providing it is accompanied with firm determination in the dog.

Dealing with the second question as to whether barking is permissible, the answer is definitely no. If one aims to enforce silence under all circumstances the amount of barking will diminish to an almost negligible quantity. Never allow the young dog to endeavour to lift "stiff" sheep by barking. Scold him immediately he barks, not so forcibly that he will turn tail and run out of range of his trainer's wrath, but sufficient to let the dog understand that barking does not meet with approval. Keep the dog stationary some distance off from the sheep for a few moments before fetching him on again. Do not allow the dog to gain the impression that there is need for hurry. It is often because the young dog is brought on too quickly that encourages barking. Personally, I prefer to allow the young dog to bite the noses of truculent sheep in any manner that offers so long as he shifts his sheep. I can always control the approach, but I could not, perhaps, teach the dog to bite later.

At this time of the year in-lamb ewes are inclined to become very difficult for a young, strong-eyed dog to lift; therefore, "schooling" is better carried out on a few hoggets or two-tooths.

The next question, as to whether a young dog should hold his ground when facing a truculent sheep, is also one that presents certain other considerations. Broadly speaking, the dog should hold his ground, but by forcing a young dog to do so the trainer would be more likely to develop fear in the dog rather than courage. It is this latter quality that enables the dog to face up to the sheep that "looks for fight." If the dog is confident that he can deal effectively with such sheep he will not give ground too easily. By working a few rams along a fence while the trainer retards their progress as much as possible by walking at their side, so as to press them on to the fence, and at the same time using a stick in between the dog and the rams, confidence can be developed. To do this the dog must not be stick-shy. If he is afraid of the stick he should be educated so that he comes to regard the stick as he does the trainer's hand. This can be achieved by continually stroking the dog with the stick and always moving the stick slowly. As the exercise of working sheep along the fence proceeds, the trainer can educate the young dog to advance at command. Should one sheep appear to be about to charge the dog the offender can be checked by using the stick. This is the best exercise I have found to develop a bold, trustworthy approach. Never expose the young dog to unreasonable danger until he is ready to deal with it and he will soon stand firm before the most truculent sheep.

Dealing with the last question, as to the difference between the long head and short head events at trials, briefly the difference is in the distance of the outrun. The long head requires the dog to pick up his sheep at about 800 yards from his handler and later holding the three sheep in a ring and driving round the ring. The short head outrun is about 440 yards, and the sheep are driven through a set of hurdles 9 feet apart, then driven along a marked course 1 chain wide to a yard 6 feet square, where the sheep are yarded without assistance to the dog. The handler is required to keep one hand on the open gate during the yarding process.—*The New Zealand Farmer Weekly.*

Grass Seeding by Airplane.

In the United States the airplane is now used as a seed planter as well as an insect duster in pest control. The Soil Conservation Service is credited with the bright idea. A lot of rough country had to be grassed, and ordinary methods of seeding were found either impracticable or too costly. With a 20-inch rainfall it was considered that a good growth of grass could be obtained and which would provide a protective cover which would be useful in preventing surface soil wash, as well as good grazing for stock. The question arose as to the best way of broadcasting grass seed over a large area, and it was decided to try seeding by aeroplane. An air-line firm took on the job, and for the purpose reconstructed the interior of a small cabin passenger plane, making room for a hopper with a capacity of 500 lb. of grass seed. Test flights were made with the hopper loaded with sawdust, to see how the idea was likely to work. Further test flights were made, using grass seed, and the seed distribution was checked on long strips of muslin. The tests proving satisfactory, actual seeding of a large area was carried out by flying at a height of 300 to 500 feet, so that the grass seed was distributed in a swathe about 100 feet wide. The flight lines used were 100 feet apart and the country was cross-seeded to ensure proper distribution. A man on the ground indicated the flight lines to the pilot, checked the distribution of the grass seed, and flag-wagged the plane from the job when the wind scattered the seed too widely. The best times for seeding were found to be from daybreak until about 10 o'clock in the morning and from about 4 o'clock in the afternoon until dusk. Altogether about 6,000 lb. of grass seed was broadcast in ten hours of flying time distributed over three days. The area seeded was just under 3,000 acres. Both distribution and germination of the grass seed were considered highly satisfactory. The cost of seeding was not too much and should be considerably less for large areas and for country not so broken. Whether adaptable to other conditions or not, or even if the method is regarded as fantastic, the tests and their practical application provided a lot of useful information and established the feasibility of adding one more peaceful and beneficial use for the airplane.

Apples not Good for Laying Hens.

Here is a good tip for the fowl yard: A woman poultry farmer tells in *The New Zealand Farmer Weekly* of her discovery that raw or cooked apple cores are *not* a good feed for fowls. This is what she says in her own words:—"My experience has been that a feed of apples will stop hens from laying if they are laying, or will delay laying if they are not already laying. The natural thing to do with a quantity of apple cores is to throw them to the fowls, but this is a mistake. On the other hand, pigs will eat apples until further orders, and there can be no doubt that apples, or parts of apples, give flavour to bacon."

Maize Values in the Dairy Ration.

Experiments at the Iowa Experiment Station show that a bushel of ground maize will be 20 to 25 per cent. more value to feed to a dairy cow than a bushel of maize in the ear, and that coarse grinding is more satisfactory than fine grinding.

Herd Testing.

As every dairy farmer knows, there is no "get-rich-quick" methods in his industry, and the only safe way is to have the best obtainable type of cow in his herd. We all realise this, hence the growing support to the herd-testing movement, which, it is computed, has in recent years doubled the profit of many dairy farmers who have tested their cows and, as a result, culled the "robbers" and the "star boarders," and so increased their milk supply at less cost.

Around the Water Trough.

Here is a point that is often observed on dairy farms, particularly on the coast during wet weather: The surroundings of water troughs frequently become a wet, muddy, unsightly source of annoyance. Not only that, but when the area around a trough is boggy the smaller cattle have a difficulty in getting to the trough, and when they do get through find it hard to get a good drink. A few loads of sand or gravel will make access easy and will soon pay for the trouble involved.

What We Owe to the Plough.

It seems sometimes that we forget what we owe to the plough and the man who works it. Many people have got so far away from natural country life that they do not appreciate their debt to the plough and the high standards set by the farmer. It is the lesson of history that civilisation of countries began to fail when their cities began to overshadow and dominate their rural life and industry.

Farm Notes

AUGUST.

AUGUST is normally a dry month throughout the State, but where good soil moisture exists the coming of warmer weather will cause an increase in weed growth, necessitating the use of cultivators in growing crops and the land being prepared for maize, cotton, sorghums, and other crops.

Well-worked land having reserves of subsoil moisture is essential for satisfactory subsequent growth, as spring-sown crops often have to withstand moderately dry conditions until the occurrence of early summer storms.

In coastal districts where frost is not liable to occur, early sowings of maize, sorghums, millets, sudan grass, pumpkins, and melons may be made. Arrowroot, artichokes, and sweet potatoes also may be planted, but unless ample soil moisture is present, there is little to be gained by very early sowings before the soil is sufficiently warm, as later-established areas will often make rapid growth, equalling or excelling that of earlier sowings.

Potato planting will be commencing in the Downs, South Burnett, and other areas away from the coast, where July plantings are likely to be affected by frost, the bulk of the spring crop being established during July and August.

Potatoes thrive in thoroughly prepared virgin soils, more especially deep, friable, well-drained alluvial loams and scrub soils, which indicates that the maintenance of a supply of humus in the soil is essential for profitable yields.

Seed potatoes for this crop are usually obtained from the Southern States, where certified seed true to varietal type is now available, but, to prevent seed-borne disease, all seed should be treated either by the hot formalin or corrosive sublimate methods, full particulars of which are obtainable from the Department. Whole sets are preferable, but cut sets may be used for the spring planting, dusting the cut surfaces with wood ashes or slaked lime shortly after cutting.

Dairy farmers in many districts will now be utilising early sown winter fodder crops to maintain production, and where crops are grazed, temporary subdivision will prove valuable in conserving growth and providing fresh pastures at frequent intervals.

On the Downs the grazing of wheat areas, intended ultimately for grain, should have ceased by late July, otherwise probable yields are likely to be considerably reduced.

LOG MEASUREMENT.

For royalty purposes, as well as for other reasons, it is sometimes necessary to estimate the number of superficial feet in a log. The following simple formula will enable this to be done.

Take one-fourth of the mean girth in inches and square it, then multiply by the length of the log in feet, and divide by 12. The mean girth is obtained either by measuring the girth in the middle of the log, or by taking the mean of the girths at both ends.

Example.—Take a log 20 feet long with a 10 feet girth at the butt end and a 6 feet girth at the other end.

The mean girth therefore is 8 feet, and one-fourth of the mean girth (in inches) is 24. Square this, multiply by the length of the log (in feet) and divide by 12.

$$\frac{24 \times 24 \times 20}{12} = 960 \text{ superficial feet.}$$

Orchard Notes

AUGUST.

THE COASTAL DISTRICTS.

(Last month's notes are repeated.)

WITH the exception of the late-ripening varieties, citrus fruits will have been harvested by now, and cultural operations should be receiving attention.

Trees showing indications of impaired vigour will require a somewhat heavy pruning, both in respect of thinning and shortening the branches. Where the trees are vigorous and healthy a light pruning only will be necessary, except in the case of the Glen Retreat mandarin. The densely growing habit of this variety leads to a profusion of weak shoots, which, if allowed to develop, will cause overbearing with resultant small and inferior fruit at an early age.

Where trees show signs of failing, look for collar rot at or near ground level. The roots should be examined for disease, and in the North Coast districts for the citrus root bark channeller. A light application of paradichlorobenzene buried a few inches deep in circular drills around the tree and with the surface stamped firmly has been recommended for controlling this pest. The distance between the circular drills should be not more than 18 inches, and care should be taken to prevent the crystals of paradichlorobenzene from coming into contact with the roots. It may be necessary to repeat the application after an interval of three or four weeks.

Where it is necessary to control brown spot of the Emperor of Canton mandarin, black spot, melanose, and scab, the fungicide should be applied at the correct time. The control measures recommended are—

For Brown Spot.

Home-made cuprous oxide mixture (3-40)—

(1) At ½ to ¾ petal fall (i.e., as soon as the majority of the fruit has set).
(2) Two months later.
(3) In late February.

For Black Spot.

Home-made cuprous oxide mixture (3-40)—

(1) At ½ to ¾ petal fall.
(2) Two months later.

For Melanose and/or Scab.

Home-made cuprous oxide mixture (3-40)—

(1) At ½ to ¾ petal fall.

Certain applications of these copper sprays may be combined with various insecticides and mixtures to correct mineral deficiencies, such as zinc. Information regarding these mixtures can be obtained from this Department.

Where for any reason healthy trees of vigorous constitution are unprofitable, they may be headed back—in fact, have the whole of the top removed—leaving a few selected arms. All other branches should be cut away at their source of origin. The three or four remaining arms, of which lengths will vary from 2 to 4 feet, will form the future framework of the tree. Care must be taken to cover the whole of the exposed bark with a suitable coating of whitewash to prevent sunburn. The numerous shoots which will grow from main arms should be suitably reduced, leaving from two to four on each arm. Under favourable conditions, these will be in a fit condition to receive selected buds from desirable trees by the following autumn. It is desirable that when shoots intended for budding have attained a length of from 6 to 9 inches, their terminals should be nipped off in order to stiffen their growth and guard against the possibility of damage by strong winds.

Fertilizing should be finished as early as possible, the mixture for the spring application being high in readily available nitrogen. Ploughing should then be completed, the depth being regulated by local conditions and the nature of the original preparation of the land. After the ploughing, the land should be worked down to a fine state of tilth. On hillside orchards, attention should be given to the control of possible storm waters. Cultivation should be so arranged as to form shallow drains or banks along the tree rows and across the heaviest slope, leading into suitable side drains which may be grassed to prevent erosion.

Planting of trees may be continued and, with the exception of custard apples, expedited. The attention of citrus growers should be confined to varieties suited to their local conditions.

Pruning of grape vines should be completed, and where cuttings for planting are required these should be selected, trimmed, and heeled-in in slightly dry soil. Canes intended for cuttings should not be allowed to lie about and dry out, but should be treated the day they are severed from the plant. Cuttings are frequently made too long. From 10 to 12 inches is a suitable length which allows for insertion in the soil so as to permit of the top bud, with a short section of the internode, protruding above the surface.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

ALL pruning, other than that applied to peaches and varieties which are late in coming into growth, should be finished this month, and the planting of young trees, if not already done, should no longer be delayed. Early planting is preferred, the sooner after the fall of leaves the better. When there are indications of the swelling of the buds, the time is opportune for working over unprofitable trees, where the stock is reasonably vigorous. Strap grafting, as advised by the local field officers, is the most satisfactory method of top-working deciduous trees.

Pruning of vines should be postponed as long as circumstances permit, and these can only be gauged on actual observation, as they are subject to much variation.

The usual winter working of the land is essential for the retention of moisture and aeration of the soil, but in shallow soils in which many orchards are planted, deep working is most detrimental.

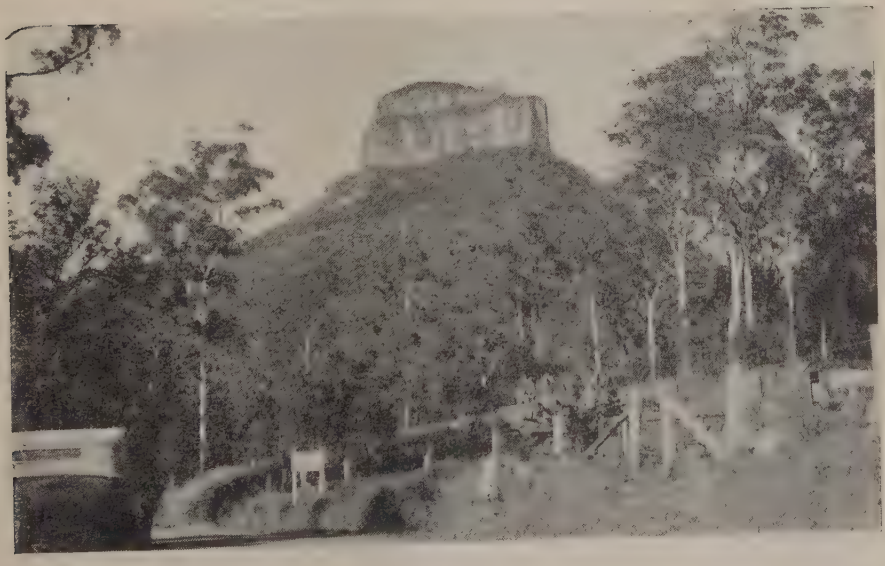
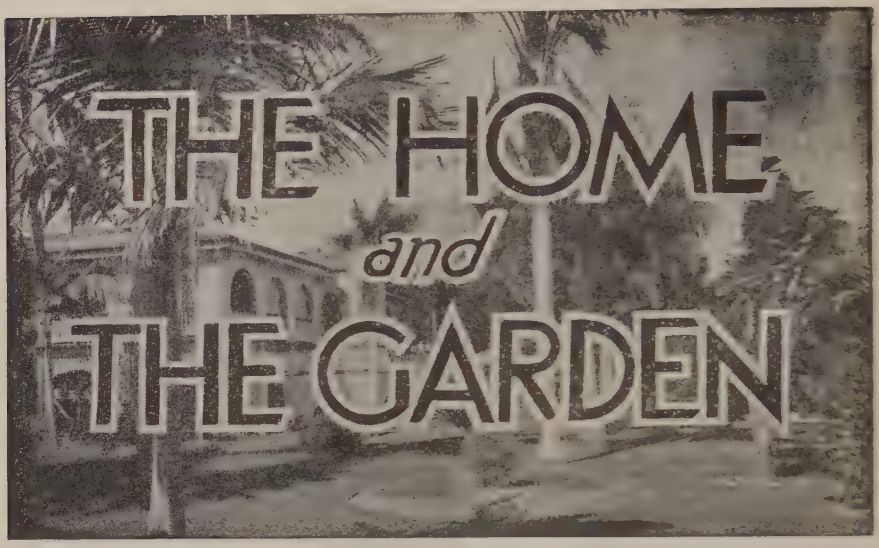


Plate 16.

MOUNT LINDESAY (SOUTH QUEENSLAND), FROM A BEND IN THE BORDER HIGHWAY.



Maternal and Child Welfare.

Under this heading is issued each month an article, supplied by the Department of Health and Home Affairs Maternal and Child Welfare Service, dealing with the welfare and care of mother and child.

BABY'S HEALTH: NATION'S WEALTH.

THE CARE OF THE PREMATURE BABY.

DO you know that in Queensland during 1940, 721 babies under twelve months of age died? About three-quarters of this number died before they reached the age of one month, the reason being that many of these babies were born prematurely, that is, before the full nine months of pregnancy were reached; or else, they were feeble, weakly infants who should have received the same treatment as those who were premature. If we could save even half of the premature babies who are born each year in Queensland, we should have a marked lowering of the infantile death rate. The sad part of it is that very many of these babies could be saved if only all mothers and nurses knew how to care for them or would obtain advice from someone who is competent to give it. I think most people have some sort of an idea that when a baby is premature he needs extra care, but we find that very few have any real knowledge of those most important *special points* in the care of these tiny babies. Such babies when born in a locality where there is a Maternal and Child Welfare Centre (Baby Clinic) should be at once brought under the notice of the Sister in Charge there. The sisters in our service have received specialised training in the care of premature and weakly babies and are always willing to advise the mother or to help her in the practical carrying out of the doctor's directions in the care of these cases. Where a country mother is able to have a child welfare trained nurse in her home for a time after the arrival of a very tiny baby, she is indeed fortunate, but for those mothers who cannot afford such help, and who live in districts where child welfare centres have not been established, the following directions may be helpful.

The Appearance of Prematurity.

A premature baby is always small, being under 5 lb. in weight. As well as being much smaller than a normal baby, he differs in appearance as well. The little body is very soft and limp, the skin wrinkled, downy and redder than usual. The infant is very weak and often too feeble to suck. The cry also is feeble and

suggestive of the mewing of a young kitten. Often baby cannot cry at all. All babies under 5 lb. in weight should be treated as premature.

Main Points in the Care of Prematures.

There are four main points which must receive immediate attention, if a premature baby has to have a reasonable chance of living. These are:—

(*a*) Prevention of chilling. (This is most important and must receive first consideration.)

(*b*) Careful feeding with mother's milk.

(*c*) Careful avoidance of infection.

(*d*) Avoidance of unnecessary handling.

Prevention of Chilling.

Because baby has come too soon he chills very quickly. A premature baby who has been allowed to become thoroughly chilled soon after birth rarely lives. Therefore, when we know that an infant is to be born prematurely, we should at once make every preparation to keep him warm from the very moment he comes into the world. For this purpose we prepare a small cot. In hospital this is an easy matter, but in a private house, particularly as baby is coming along before mother has everything ready, a cot may not be available. However, we need not worry about that. A very satisfactory and comfortable bed for the wee one can be very quickly improvised. Half of an old fashioned wicker dress basket does splendidly, and failing this, the family clothes basket. Even a big box or a drawer out of the duchess may be brought into service. To prepare the improvised cot first line it with either brown paper or newspaper: this is to prevent the escape of heat. After this, and for the same reason, line the inside with blanket. A strip of old blanket or a wide woollen scarf can be used. To fix this place it outside the basket so that it reaches from top edge to bottom and fasten it securely either with a string tied round the top or by sewing through the basket and blanket at intervals. Having done this turn the blanket over inside the basket so that it is completely lined and also has a tidy top edge. Then throw a single blanket lengthways over the basket so that it does not reach quite to the head. Place a firm pillow in the bottom and a soft one over it to form a mattress. A flannelette napkin will serve as a sheet and a small folded fine soft towel as a pillow. At first a mackintosh will not be necessary, but later it should be provided. Place hot bottles in this specially-prepared cot and keep it well warmed until baby arrives. As soon as he is born baby should be wrapped in warmed cotton wool or soft flannel and placed in this cosy well-warmed cot and kept there until he is thoroughly warmed. He should not be moved for at least eight hours. Premature babies are never bathed in the ordinary way, but when baby is thoroughly warmed he may be cleansed with a little warm olive oil, using cotton wool swabs. Do not take him out of his cot to do this, and carry it out as quickly as possible, uncovering only one portion of his body at a time (say, one arm or one leg). Take care not to move or handle baby any more than you can help. The cot should be in a warm place and screened from draughts while this is being done. A premature baby chills so easily that he needs more warmth in the cot than is provided by the bedclothes. This should be supplied by hot water bags or bottles. Rubber bags are best, but if they are not available, some ginger beer bottles or ink bottles will serve. In cold weather three are required, one at the foot and one at each side. The bag at the foot of the bed is placed between the two pillows, the side ones lie, not against baby's body, but well tucked down at the side between the enveloping blanket and the mattress. See that the necks of the bottles are pointing towards the foot of the cot. This is important in case any leakage occurs. For the bottle at the foot use two-thirds boiling water and one-third cold water. For those at the side use equal parts boiling and cold water. These require to be refilled one every hour in rotation during cold weather. In warm weather two bags are usually sufficient once baby is thoroughly warm and they do not need changing so often. Although baby needs to be kept warm you must not deprive him of fresh air. In our Queensland climate the air, even in winter, is not cold enough to hurt the premature baby provided his bed is kept properly warm, and in the hot parts of the State, and in very hot summer weather, you must guard against overheating. If you can obtain a dairy thermometer you can keep it inside the bedclothes, and it should register between 85 and 95 degrees Fahrenheit. As baby's strength improves gradually decrease the artificial heat. Oil him every second day, taking the same precautions as for the first oiling. Do not bath him until he weighs at least 5 lb. without his clothes, and if the weather is very cold he may safely be left longer. Commence by sponging the face and hands and gradually increase until he is being fully sponged and later bathed.

Feeding.

Feeding this tiny baby is the second important point, and if it can possibly be obtained, he should have mother's milk. We all know that the normal, healthy baby thrives best when fed on his own mother's milk, so for the premature it is even more necessary; in fact, few premature babies thrive without it. You can easily realise that the digestive organs of this tiny infant are not educated up to the demands of independent life, and only the most easily digested food like mother's milk can be tolerated, and even this has sometimes to be diluted at first. Failing his own mother's milk, the milk of another healthy mother is the next best thing. Sometimes a relation or friend who has a healthy baby of her own is able to act as foster mother. It does not matter if the foster mother's baby is some months old; the milk will not hurt the premature baby on that account, although it is advisable to dilute it at first and also to boil it before giving it to the baby. If only a small amount of milk is available either from baby's own mother or the foster mother, it will be necessary at first to make up to the full requirement with whey or—where fresh cow's or goat's milk is not procurable—with weak condensed milk mixture. It is most important to begin with a weak mixture, because the consequences of commencing the feeding of a premature baby with too strong a mixture may be serious. It is advisable, however, where either a part or complete artificial feeding has to be given, to seek the advice of the Child Welfare Sister, either personally or by letter, as a premature is so very easily upset by wrong feeding. Nothing but warm boiled water should be given to baby for the first twelve hours of his life, but after that he must have food. It is impossible to say how much baby should have at a feed. Some very tiny, feeble babies are quite unable to suck and almost unable to swallow. Such cases must be fed from a pipette or eye dropper with about 2 inches of soft rubber tubing on the end. If baby is only able to take very little—say, one or two teapsoons at a feed—he must be fed every hour with one three-hourly interval at night. As he takes more the time between the feeds is gradually lengthened (by a quarter of an hour at a time) to two hours and then later to three hours. As soon as he shows signs of attempting to suck, a small feeding bottle with a soft teat may replace the eye dropper. Do not lift baby from his cot to feed him until he weighs 5 lb. The milk should be expressed for him and fed from dropper or bottle. When he weighs 5 lb. he may be put to the mother's breast, but only for a minute or two as he becomes easily tired and is liable not to suck sufficient. The remainder of his feed is expressed either by hand or breast pump and fed to him with his bottle. Every effort must be made to maintain and increase the mother's milk supply.

Prevention of Infection.

The third important point in the care of the premature baby is to prevent his becoming infected with any illness such as a cold, influenza, &c. Because he is weak and undeveloped baby is very susceptible to infection and even a common cold in an attendant or visitor can easily lead to a fatal pneumonia in a premature baby. You will find that all your friends and neighbours will want to come along and look at baby because he is so tiny. However hard it may seem, you will have to tell them gently but firmly that baby must not have visitors until he is stronger. It is better to risk offending these people than to risk your baby's life. If mother or nurse develops a cold and cannot be relieved from the care of baby she should tie a pad of from four to five thicknesses of butter muslin over her nose and mouth while attending to him.

Avoidance of Handling.

This fourth important point, although we have left it till the last, is one which needs to be very carefully observed. Handling is very harmful to the feeble premature baby, and is often the cause of attacks of asphyxia. Until he shows signs of increasing strength, he should not be lifted from his cot while he is fed or oiled, and he should be handled as little as possible when he is changed. Some alteration of position is necessary however, and he should be gently turned from one side to the other twice or three times a day.

Result of Care.

The care of a premature baby calls for not only a great deal of trouble, care, and patience, but a high degree of skill. We know of many babies weighing as little as 2 or 3 lb. at birth, who, under skilled care, have lived and developed into strong, healthy children. The successful rearing of such an infant is justly a source of pride to mother and nurse.

You can obtain further advice on this or any other matter relating to the feeding and management of children up to school age by writing to "Baby Clinic, Brisbane." Such letters need not be stamped.

IN THE FARM GARDEN.

TRANSPLANTING SHRUBS.

DR. D. A. HERBERT.

WITH the coming of wintry weather, many of our trees and shrubs passed into a state of comparative rest. It is in their dormant or semi-dormant condition that they can be most safely transplanted, so this is the important season for planting out new trees and shrubs, or for moving them round from one part of the garden to the other. Many a garden would be improved by a rearrangement of the larger and more permanent plants. Roses, for example, on the south or shady side of the house often suffer from mildew, but if shifted to a sunnier position are comparatively free from the disease, especially if at the time of transplantation a liberal quantity of wood ash is worked into the soil. The only limits on transplantation of most shrubs and trees are imposed by their size. If they can be lifted with a good ball of earth round the roots they generally take up a new position without much trouble, but, of, course, the labour involved in moving a large tree is usually too great for the home gardener. When a large shrub, such as a hibiscus, is to be transferred to another site a trench is dug round it about 18 inches from the trunk and a foot or so deep. The circular cake of earth contains most of the important roots, but many have to be cut; consequently, some pruning back of the top is necessary to balance the depleted root system. The amount of pruning depends on the amount of root that has been removed. The plant is then lifted with as little disturbance to the remaining soil as possible and placed on a bag for removal to the new position. The bag is wrapped round to prevent the shaking off of the earth, and it need not be removed when the shrub is put into the hole. It will rot in a short time.

Shrubs and trees bought from the nursery are either balled or in pots. Those in pots frequently have their roots coiled round. It is a mistake to try to straighten these out; they have grown in that position within the confines of the pot and any attempt to spread them out will probably result in cracking them. One thing to remember in planting out these or any other plants is to press the soil firmly round the roots. One of the commonest causes of failure in transplantation is too much gentleness in pressing the earth down. The slogan should be, "Put in the boot!" Looseness round the roots induces drying out just where moisture is essential. A good watering after planting is beneficial, not only because of the water supplied, but because it settles the soil into position and fills up those crevices round the roots.

Many plants exposed for sale are marked "grafted varieties." The term in itself does not imply any guarantee of quality unless the actual variety is specified. It simply means that the stem of one variety has been surgically united with the root of another. You could graft a bush lemon on a Lisbon lemon root; it would be a grafted plant, but you would get only bush lemons from it. Grafting is a simple operation, but involves a certain amount of time and care; so that any plant sold as a grafted variety may reasonably be expected to be a good variety grafted on a hardy root. Many plants grown from seed are of indifferent quality, and the operation of grafting transforms them into good types, by reason of the fact that good varieties are chosen to graft on as tops or scions. Budding is a type of grafting and most roses are budded. Lemons, oranges, and other citrus should be obtained as budded or grafted plants, and so should custard apples. Queensland nuts are now being budded and good varieties with large nuts are available. Where it is intended to raise a tree or shrub that may last a lifetime in the garden, it is a mistake to keep an indifferent seedling when a good quality plant can be obtained at very little cost. Of course, there is no need to look for grafted varieties of shrubs which strike readily from cuttings and are perfectly hardy on their own roots—as is the case with hibiscus, lagerstroemia, croton, acalypha, hydrangea, and a host of others—but when plants are offered with this label, they can generally be assumed to be of some special merit.

IN THE FARM KITCHEN.

STEAMED PUDDINGS.

Steamed Chocolate Pudding.

Dissolve 2 oz. plain chocolate in 1 tablespoon milk by heating it over boiling water. Beat until smooth and allow to cool. Cream 4 oz. butter and 4 oz. sugar until almost white and very light; add 2 eggs, one at a time, then 5 oz. plain flour sifted with 1 level teaspoon baking powder. Add a tablespoon flour at a time and beat mixture well after each is added. Now add chocolate mixture and a few drops vanilla essence. Mix well without beating too much. Steam in a well-greased basin and cover with greased paper for 2 hours. Serve with chocolate or any sweet sauce.

Apple Batter Pudding.

Cream 1½ oz. butter with 1½ oz. sugar until light. Beat 2 eggs well and add half of it to butter mixture, then 1 oz. plain flour and a good pinch of salt. Now add the remaining egg and another ounce of flour and the grated rind of ½ lemon. Gradually add a little more than ½ pint milk (if eggs are large, use ¾ pint) and allow batter to stand for 1 hour. In the meantime, peel and chop 2 large apples into dice and fry them in a little butter until very hot, but not quite cooked. Place them in a well-greased flat fire-proof dish, sprinkle over a little sugar and ground cinnamon to taste, then pour over batter. Bake in a hot oven for about 45 minutes or until batter is set.

Steamed Lemon Pudding.

Line a pudding basin with a shortcrust, not too rich, and reserve enough for covering top. Mix 1½ oz. cornflour with a little cold water, then pour on ½ pint boiling water, stir for a few minutes, then place in a saucepan over a low gas and stir until mixture is clear. Add 6 oz. sugar, the juice of 2 lemons, and the grated rind and the yolks of 3 large eggs. Pour this into lined basin, cover with remaining pastry. Cover with greased paper and steam very gently for 45 minutes. Turn out carefully, or it may be steamed in a souffle dish and served in the same dish instead of turning it out.

Steamed Date Pudding.

Butter a pudding basin and line it with stoned dates, pressing them well on to sides of basin. Cream 4 oz. butter with 4 oz. sugar until light and white. Sift 6 oz. plain flour with 1 level teaspoon baking powder and a good pinch of salt. Add 1 unbeaten egg to butter, beat well, then add a little of the flour. Add another egg and beat that well in. Add about 1 dozen chopped dates to remaining flour and add to butter mixture. Lastly, add a little milk to form a dough that will drop from the spoon easily. Put mixture into lined basin, cover with buttered paper, and steam for 2 hours. Turn out carefully and serve with sweet sauce.

Baked Sultana Rolls.

Sift 2 cups plain flour with ½ level teaspoon salt, 4 level teaspoons baking powder, add 2 level tablespoons sugar, then rub in 3 level tablespoons butter. Form into a dough with 1 beaten egg and ½ cup milk. Roll out to about ¼ inch thick. Spread with a little butter, 2 cups sultanas, the grated rind of 1 lemon, 1 level teaspoon ground cinnamon, and 2 tablespoons brown sugar. Roll up like a Swiss roll and cut into slices about 2 inches thick. Boil 1½ cups sugar with 2 cups water for 5 minutes, then turn into large flat oven-proof dish. Place the rolls cut side down in the syrup, sprinkle tops with a little more sugar and place a small dot of butter on top of each roll. Bake in a moderate oven for 45 minutes or until a nice golden brown and cooked through.

Steamed Wholemeal and Honey Pudding.

Pour 1 cup hot water over 2 cups fine white breadcrumbs (or wholemeal). Allow to soak for a few minutes, then add ½ cup finely-chopped suet, 1 cup sultanas, 1 cup wholemeal flour, ½ cup honey, 1 well-beaten egg, a little grated nutmeg, ground cinnamon, and a little mixed spice if liked. Dissolve ½ teaspoon bicarbonate of soda in 1 tablespoon hot water and add to mixture. Beat well together and steam in a well-greased mould for 3 hours. A little sugar may be added if needed a little sweeter. Before serving, stud with blanched whole almonds.

Surprise Fritters.

Mash 3 bananas well and mix with 1 tablespoon stiff apricot jam, a little desiccated coconut, and enough fine white breadcrumbs to bind mixture together. Divide mixture into equal portions and flatten out a little. Roll out ½ lb. puff or short pastry and cut into large rounds about 3 inches in diameter, then roll out lightly into an oval shape. Place a portion of the mixture on each pastry, fold over and pinch edges together. Roll in egg and breadcrumbs and fry in boiling lard or good dripping until a golden brown. Drain well and serve piping hot.

Baked Banana Sponge.

Sift 1 level cup plain flour with 2 level teaspoons baking powder, a good pinch of salt, then add 2 level tablespoons sugar. Melt 1 dessertspoon butter in a saucepan, remove from gas, and add ¾ cup milk and 1 well-beaten egg. Mix well into a batter and place in a well-greased shallow dish. Peel and cut 4 or 5 bananas into halves and press them into the batter. Sprinkle with castor sugar mixed with a little grated lemon rind. Dot with a little butter and bake in a moderate oven for 20 minutes.

OTHER DISHES.

Eggs Au Gratin.

Boil 4 eggs hard, then remove shell and cut in halves lengthwise. Pound the yolks fine and add 4 tablespoons grated cheese, 2 heaped tablespoons fine white breadcrumbs, pepper and salt to taste, and if liked a little grated nutmeg. Add just enough white sauce to bind mixture together, then fill the white, forming the mixture into an oval shape. Arrange eggs in a well-greased fireproof dish, pour over about 2 cups cheese-flavoured white sauce, sprinkle over breadcrumbs mixed with some finely grated cheese. Dot with butter and bake in a hot oven until nicely browned.

Apple Shortcake.

Melt 1 level tablespoon butter in a saucepan, add 2 tablespoons sugar and stir over a low gas until melted. Add 4 peeled, cored, and sliced apples and cook for a few minutes. Add a little cinnamon, and if liked 3 or 4 cloves. Place them in a shallow fireproof dish and cover with the following:—Cream 4 oz. butter with 1 tablespoon castor sugar until light and creamy; now add 5 oz. plain flour and heat for a few minutes. Place in small spoonfuls on top of apple, sprinkle with icing sugar, and bake in a moderate oven for about half an hour. Serve hot or cold.

Fried Sandwich.

Cut white or brown bread into slices, not too thin, and butter both sides. Put some good tasty cheese through a mincer, also some crisp celery. Place a dish under mincer to catch any juice that may be extracted from celery and add it to cheese mixture with about 1 teaspoon onion juice. Add pepper and salt to taste and a little mustard. Mix well together and spread thickly on bread and join three slices together. Fry slowly in a little butter until a nice brown on both sides.

Potato Cakes and Bacon.

Sift 4 oz. plain flour with pepper and salt to taste. Rub in 2 oz. butter or good dripping. Add 8 oz. well-mashed cold potato and enough milk to form a stiff paste. Roll out and stamp in rounds and fry in hot fat until a golden brown. Serve with grilled bacon.

Cream of Tomato Soup.

Wash 1½ lb. tomatoes and cut up roughly. Put in a saucepan with 1 blade of whole mace, 2 cloves, a small minced onion, and 2 bay leaves, salt and pepper to taste, and a pinch of bicarbonate of soda. Cook gently until tender, remove bay leaves, &c., and rub through a fine sieve. Melt 2 dessertspoons butter in a saucepan, add 1 tablespoon plain flour, cook a little, then add 2 pints warm milk. Stir until it thickens and then allow to simmer for 5 minutes. Now add puree and carefully reheat. A little sugar may be added, also a little cream. On no account allow the soup to boil or the soup will curdle.

Apple Butterscotch Pudding.

Crush 3 oz. butterscotch finely and put aside. Peel and slice 4 or 5 apples thinly, place them in a basin and sprinkle over 1 tablespoon sugar, the grated rind of 1 lemon, and ½ orange. Melt 2 level tablespoons butter in a saucepan, add 2 cups fine white soft breadcrumbs. Stir well over fire until butter is absorbed. Place half of the crumbs in the bottom of a well-greased fireproof dish, cover crumbs with a quarter of the apples. Mix together ½ cup sugar, ½ level teaspoon grated nutmeg, ½ level teaspoon ground cinnamon, and sprinkle half of it over the apple. Now add half of the remaining crumbs, then another layer of apples, &c. Pour over the lemon and orange juice, then cover with remaining crumbs. Cover with a tight-fitting lid and bake about 45 minutes in moderate oven. Remove lid and sprinkle with crushed butterscotch and place in a hot oven until brown and butterscotch is melted. Serve hot or cold.

CHANGES OF ADDRESS.

Subscribers are asked to kindly notify changes of address to this Department without delay.

ASTRONOMICAL DATA FOR QUEENSLAND
JULY, 1941.

By A. K. CHAPMAN, F.R.A.S.

SUN AND MOON.
AT WARWICK.

Aug.	SUN.		MOON.	
	Rises.	Sets.	Rises.	Sets.
	a.m.	p.m.	a.m.	a.m.
1	6.33	5.23	11.54	12.18
			p.m.	
2	6.33	5.24	12.43	1.21
3	6.33	5.24	1.36	2.23
4	6.32	5.24	2.32	3.24
5	6.31	5.25	3.31	4.21
6	6.31	5.26	4.31	5.14
7	6.30	5.26	5.30	6.4
8	6.29	5.26	6.29	6.49
9	6.28	5.27	7.25	7.30
10	6.27	5.28	8.20	8.9
11	6.27	5.28	9.13	8.45
12	6.26	5.29	10.5	9.20
13	6.25	5.29	10.57	9.56
14	6.24	5.29	11.48	10.33
15	6.23	5.30	nil	11.12
			a.m.	
16	6.22	5.31	12.39	11.52
			p.m.	
17	6.21	5.32	1.30	12.36
18	6.20	5.32	2.21	1.23
19	6.19	5.32	3.11	2.14
20	6.18	5.33	3.59	3.8
21	6.17	5.33	4.47	4.4
22	6.16	5.34	5.32	5.3
23	6.16	5.34	6.16	6.3
24	6.15	5.34	6.58	7.5
25	6.14	5.34	7.40	8.7
26	6.13	5.35	8.23	9.9
27	6.12	5.36	9.7	10.11
28	6.11	5.36	9.52	11.15
29	6.10	5.37	10.41	nil
				a.m.
30	6.8	5.37	11.32	12.17
			p.m.	
31	6.7	5.38	12·26	1.17

Phases of the Moon.

7 August, Full Moon, 3.38 p.m.
15 ,, Last Quarter, 11.40 a.m.
23 ,, New Moon, 4.34 a.m.
30 ,, First Quarter, 12.4 a.m.

THE GREAT POWER STATION.

LAST month we were at our farthest from the sun, that vast globe of brilliant light, the magnitude of which we do not realise, because we are so accustomed to its apparent size at a distance of about 93,000,000 miles. The sun must be enormous to be seen at all at such a distance—a distance which would take a wireless wave eight minutes to traverse, or a plane, flying 160 miles per hour, 66 years. This mighty globe is so stupendous that were 1,300,000 earths rolled together into one huge ball, the resulting globe would only then equal the sun in size. To use a more homely comparison—if a football represented the sun, a small-sized shot would be large enough to represent the earth. The temperature at the sun's surface is known fairly accurately to be about 10,000 degrees Fahr.; this means that every square foot of the solar surface is continually radiating about 1,350 horse-power. A small fraction of the sun's surface, therefore, would give sufficient horse-power to energise all the machinery of the world. The function of the sun, however, is not to drive machinery, but to control and energise eight great worlds and the whole far flung solar system over which he holds unchallenged lordship. Yet the sun, which in every way is tremendous to us, almost beyond our conception, is but a very medium-sized star; one of a hundred thousand million, which is the number of suns estimated by astronomers to make up our galaxy of stars, a few only of which we see in our night skies.

EVERLASTING MIDDAY.

The nearest world to this stupendous power station is Mercury, a little world only 3,000 miles in diameter. As its average distance from the sun is but 36,000,000 miles, the sun's attraction is great. Perhaps it once spun rapidly on its axis, giving the little world day and night, but the action of the sun gradually caused its rotation to slow down till at length it rotated only once in one revolution round the sun, like our moon which rotates once in one revolution round the earth; Therefore, on Mercury, there must be a perpetual midday, on one side of blinding light and blistering heat; on the other hemisphere perpetual night and intense cold would reign for ever.

Towards the end of last month Mercury was visible as a morning star, but this month it will be too near the sun to be seen. On 19th August it will be almost behind the sun.

Another 31,000,000 miles brings us to the orbit of Venus. Venus is now the evening star, setting about 7.20 o'clock. On 18th August Venus will appear a little south, but quite near the distant planet Neptune. A telescope will be necessary to see this remote member of the sun's family, which appears about as bright as a mag. 8 star. On 25th August, about 6 o'clock, Venus will be very near and a little south of the slender crescent moon. They will keep together until moon-set, which will be soon after 8 p.m.

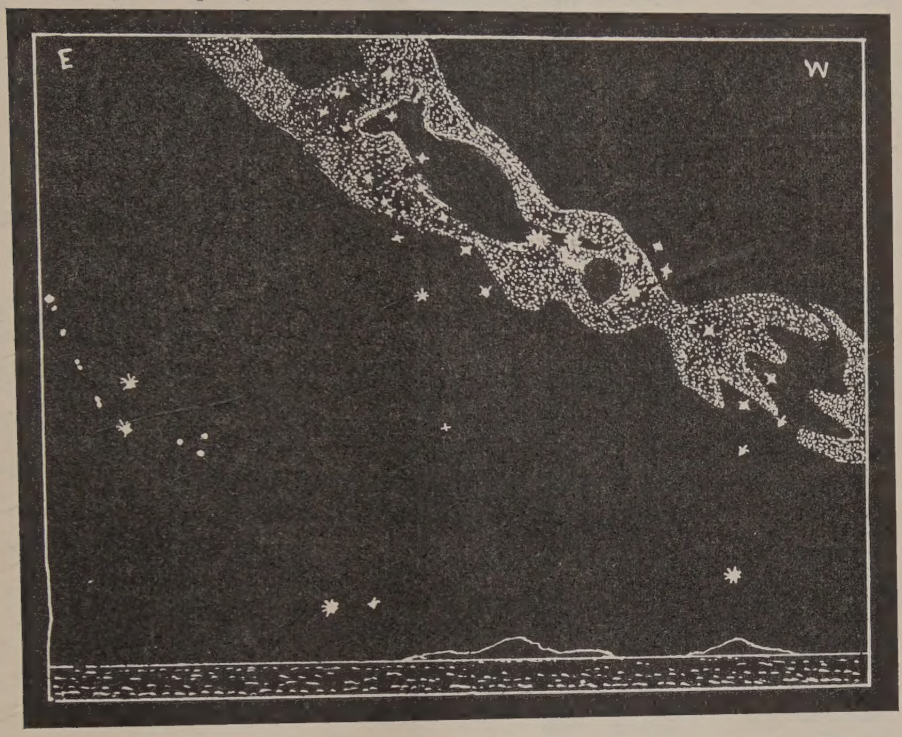
Mars rises now at 10.17 p.m. among the small stars of Pisces. It may be seen not far from the moon on 12th August.

Jupiter and Saturn are morning stars. Saturn rises about half-past 1 o'clock not far from the Pleiades, while Jupiter rises 86 minutes later.

AUGUST METEORS.

In August quite a number of meteors are often seen in the early morning. They are most numerous from 10th to 12th August, although some may be seen before and after that period. They come from a radiant in the northern constellation of Perseus, which is north of the Pleiades and are, therefore, called the Perseids. Some years they appear in greater abundance than other years. It was shown, many years ago, that these meteors moved in the same orbit as Tuttle's comet, which was discovered in 1862. There are strong reasons to believe that the August meteors are fragments of this comet, which are continuing to traverse the path of the parent body. In August of each year the earth passes through this invisible stream, and many fragments are swept up by the earth and consumed by its atmosphere.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S., add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.



LOOKING SOUTH IN AUGUST.

Many of the stars of the southern sky are circumpolar; they circle the South Celestial Pole and never set. There is no bright star at this pole; its position is marked in the picture by a small cross. Around this dark point the whole heavens appear to circle every twenty-four hours. It is the rotating earth which causes the stars to have this apparent circular movement.

On clear, moonless nights the Milky Way is most conspicuous. It has no distinct outline, but in many places there are long dark rifts and black patches. These are due to dark nebulæ—immense clouds of cosmic dust obscuring the stars beyond. Of late years astronomers have given much study to the Milky Way. They consider that the hundred thousand million stars which make up our galaxy are confined within an enormous, flat lens-shape. If we are somewhere near the centre of this lens and look towards the edge or circumference we should see an immense number of stars, but at right angles to the edge we should see few.

WHAT IS THE MILKY WAY?

When looking at the Milky Way, we are looking towards the edge of the great star-filled lens.

In the March Journal the April southern sky was shown; then the Southern Cross was as far on the eastern side of the South Pole as it is now on the western. This shows how far the Cross moves in four months in its annual journey round the Pole, or besides its daily revolution round the Pole the Cross has an annual motion. It is once only in the year that the Cross is exactly upright above the Pole at midnight.

In the March Journal it was mentioned that some tribes of Australian blacks pictured a large black Emu in the Milky Way. This is quite conspicuous when found. The Coal-sack, the pear-shaped black patch near the Southern Cross, represents the emu's head. A long, narrow, black rift running down near the two "Pointers" is the neck, which farther down opens out to form the breast and body of the giant bird.

From Ipwich way a reader says he was very interested to find the Blackfellow's Emu, which was something new to him. He very kindly pointed out the figure of a feeding kangaroo, which was quite new to me. The head of the 'roo is where the tail of the emu should be; the body is common to bird and beast, but the long neck of the emu becomes the tail of the 'roo. There is even a little black rift to mark the small forelegs of the marsupial. I must confess that the head and forepart is not very clear to me, but given imagination, good eyesight, and no city lights this figure may very well be seen.

The Cross points nearly across the Pole to the bright star Achernar, which is now rising near the south-east horizon. About halfway along a line drawn from this star to Beta Centauri, the "Pointer" nearest the Cross, is very near the South Celestial Pole. That "Pointer" is a tremendously hot and brilliant sun. The "Pointer" farthest from the Cross is Alpha Centauri—the nearest bright star to the earth, however, it is about 26 billion miles away; Beta Centauri is more than twenty times farther! Below Alpha Centauri are two fainter stars near the edge of the Milky Way which, with another farther out, forms the Southern Triangle. The three stars, with Alpha Centauri, form a diamond shape. At the eastern edge of the picture is Grus, the Crane. The two bright stars form the uplifted wings, while a long line of small stars outlines the outstretched neck; behind the wings the tail is formed by three small stars. Near the south-west corner is the lone, brilliant star Canopus, of the Ship Argo. This is the second brightest star in the sky, now getting low towards its setting, while Achernar, farther to the east, is rising.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF MAY IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING 1941 AND 1940, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	May.	No. of years' records	May, 1941.	May, 1940.		May.	No. of years' records	May, 1941.	May, 1940.
North Coast.	In.		In.	In.	*South Coast—contd.*	In.		In.	In.
Atherton	2·28	40	4·62	3·56	Gatton College ..	1·56	42	0·93	0·86
Cairns	4·43	59	7·33	2·33	Gayndah	1·55	70	1·74	0·61
Cardwell ..	3·58	69	7·06	3·44	Gympie	2·80	71	12·14	1·20
Cooktown ..	2·74	65	4·75	0·99	Kilkivan	1·81	60	4·34	1·35
Herberton ..	1·72	55	2·11	2·35	Maryborough ..	2·97	70	7·07	1·32
Ingham	3·70	49	5·98	4·00	Nambour ..	5·05	45	10·69	3·18
Innisfail	12·29	60	22·77	7·51	Nanango	1·53	59	2·09	1·78
Mossman Mill ..	3·62	28	4·36	2·28	Rockhampton ..	1·58	70	1·99	0·31
Townsville ..	0·92	24	2·39	0·16	Woodford ..	2·98	54	5·39	0·90
Central Coast.					*Central Highlands.*				
Ayr	1·05	54	3·35	0·28	Clermont ..	1·28	70	2·10	0·27
Bowen	1·25	70	3·88	0·79	Gindie	0·89	42	..	Nil
Charters Towers ..	0·75	59	2·68	0·29	Springsure ..	1·22	72	1·37	0·58
Mackay P.O. ..	3·79	70	15·53	2·05	*Darling Downs.*				
Mackay Sugar Experiment Station	3·35	44	4·31	1·18	Dalby	1·29	71	0·68	2·80
Proserpine ..	4·17	38	7·76	2·82	Emu Vale ..	1·12	45	1·38	0·76
St. Lawrence ..	0·54	70	2·41	0·34	Hermitage ..	1·35	35	..	Nil
South Coast.					Jimbour	1·22	62	0·35	3·79
Biggenden ..	1·73	42	4·44	0·41	Miles	1·49	56	1·28	0·72
Bundaberg ..	2·57	58	6·21	0·63	Stanthorpe ..	1·76	68	1·66	0·55
Brisbane ..	2·80	89	3·23	0·71	Toowoomba ..	2·16	69	1·13	1·74
Caboolture ..	3·27	65	4·96	1·37	Warwick ..	1·49	76	1·18	0·97
Childers	2·10	46	5·08	0·19	*Maranoa.*				
Crohamhurst ..	5·00	48	9·96	2·21	Bungeworgoral ..	0·95	27	1·78	0·62
Esk	2·02	54	1·66	1·32	Roma	1·42	67	1·56	0·65

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CLIMATOLOGICAL TABLE—MAY, 1941.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Mean Atmospheric Pressure, at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.				Total.	Wet Days.
		Max.	Min.	Max.	Date.	Min.	Date.		
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points	
Cooktown	..	80	70	82	7, 17	60	27	475	23
Herberton	..	69	58	75	9	45	31	211	24
Rockhampton	30·12	77	61	82	10, 24	50	1	199	8
Brisbane	30·21	73	56	80	2	51	17	323	9
Darling Downs.									
Dalby	..	73	47	79	1	37	15	68	4
Stanthorpe	..	66	40	75	1	27·3	17	166	7
Toowoomba	66	66	50	75	1, 2	38	25	113	7
Mid-Interior.									
Georgetown	30·00	86	62	92	8, 9, 10	51	31	46	1
Longreach	30·12	79	53	84	2, 23	42	27	75	3
Mitchell	30·20	72	45	80	3	31	16	186	6
Western.									
Burketown	..	86	64	92	8, 9	55	26, 30, 31	42	2
Boulia	30·07	79	52	86	18, 23	40	1	Nil	..
Thargomindah ..	30.20	74	50	83	23	39	26, 27	24	3